FIG.1

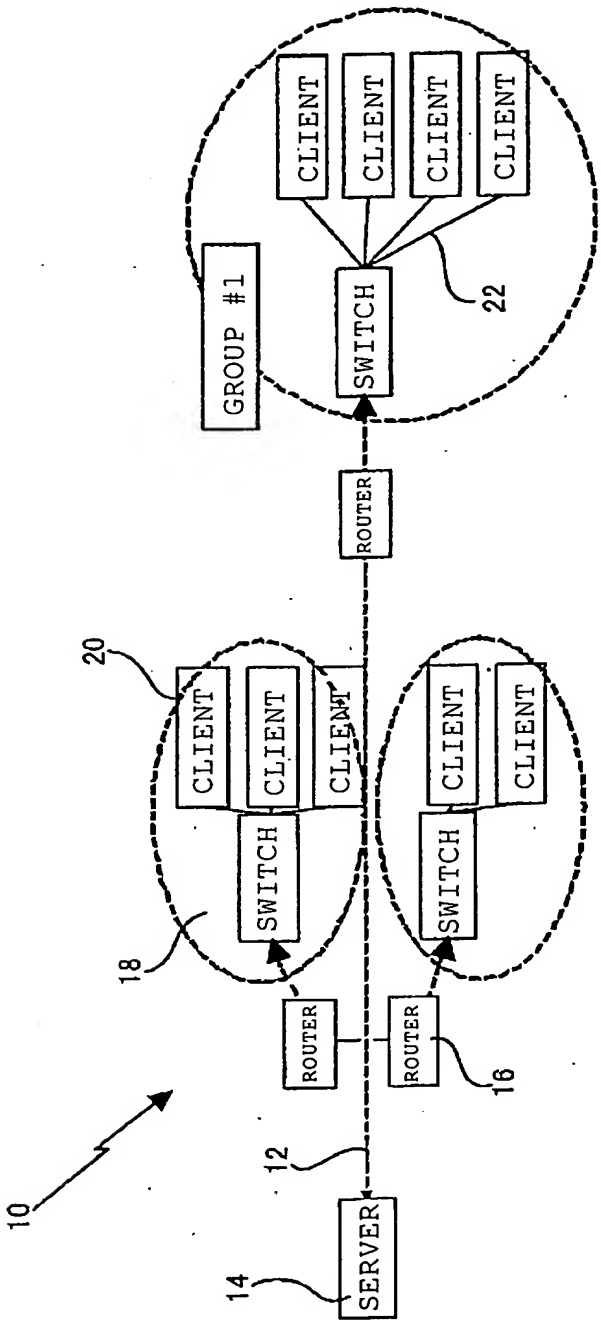
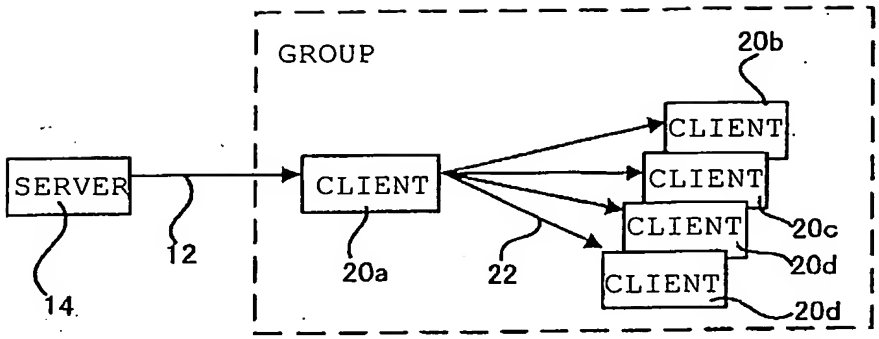
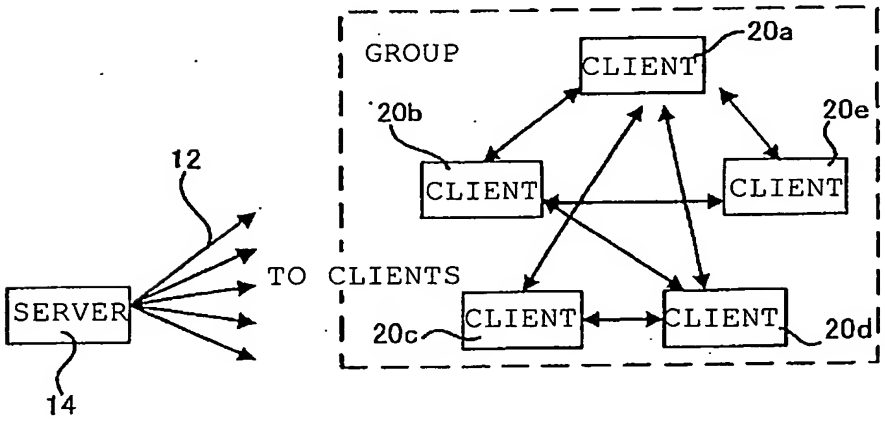

CLIENT
CLIENT
CLIENT
CLIENT
GROUP #1
SWITCH
22
ROUTER
20
CLIENT
CLIENT
CLIENT
CLIENT
CLIENT
SWITCH
SWITCH
18
ROUTER
ROUTER
16
10
12
SERVER
14

FIG. 2


GROUP
20b
CLIENT
CLIENT
CLIENT
CLIENT
20c
20d
20d
SERVER
CLIENT
12
14
20a
22

(a)


GROUP
CLIENT
20a
20b
20e
CLIENT
CLIENT
12
TO CLIENTS
SERVER
CLIENT
CLIENT
20c
20d
14

(b)

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FIG.3

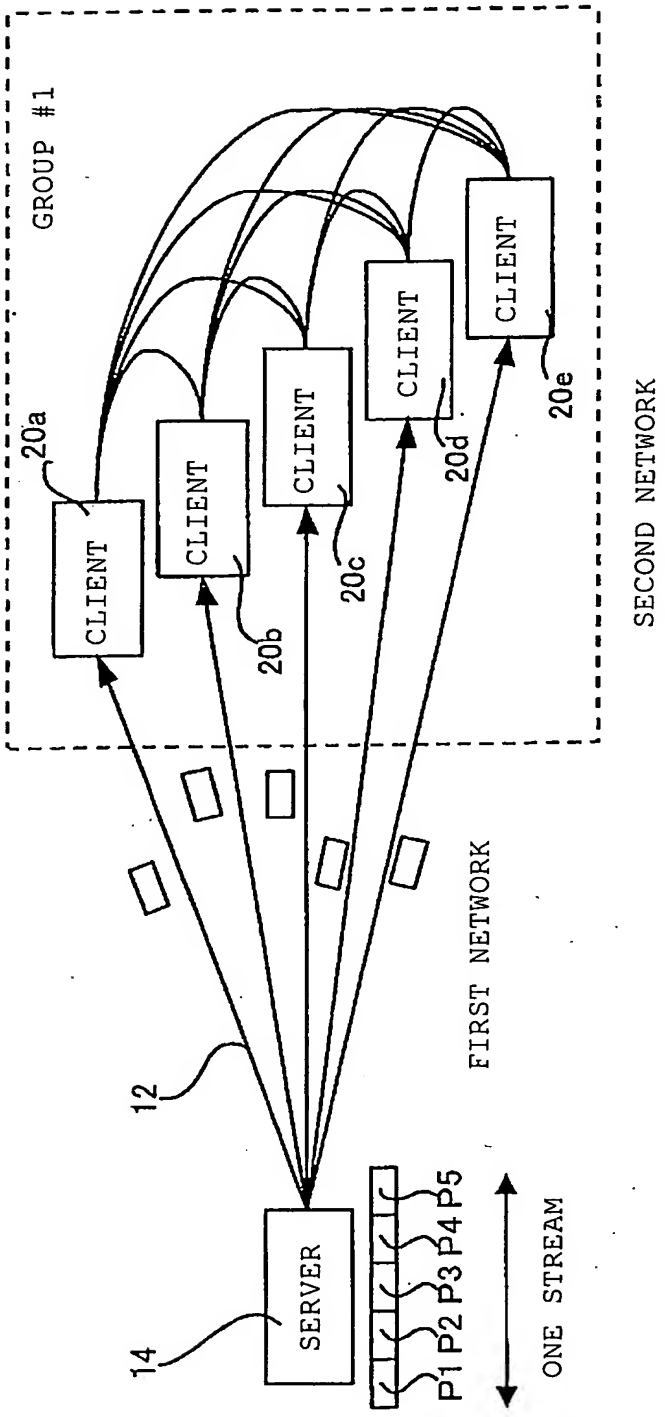
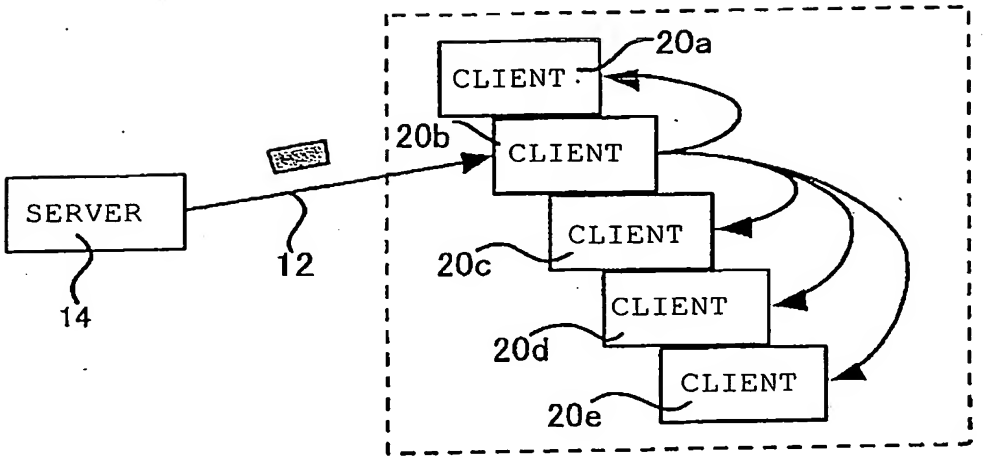
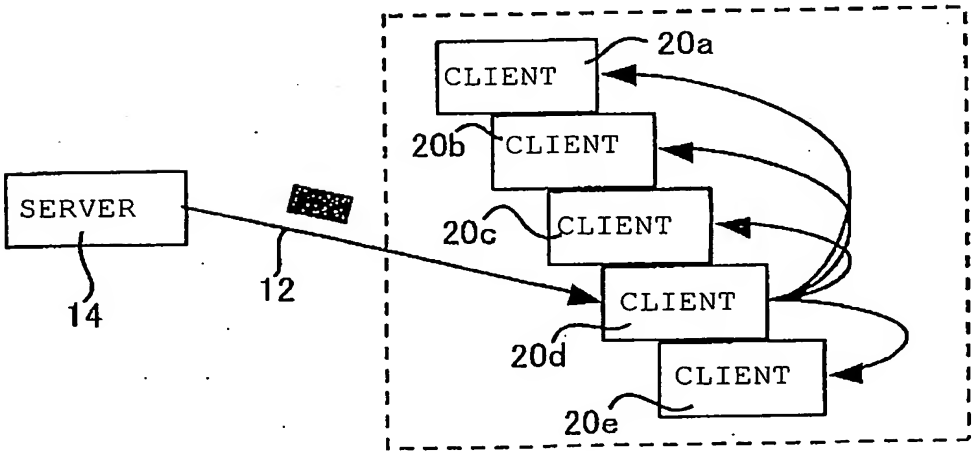


FIG. 4


SERVER
14
12
CLIENT
20a
20b
CLIENT
CLIENT
20c
CLIENT
20d
CLIENT
20e

(a)


SERVER
14
12
CLIENT
20a
20b
CLIENT
CLIENT
20c
CLIENT
20d
CLIENT
20e

(b)

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FIG.5

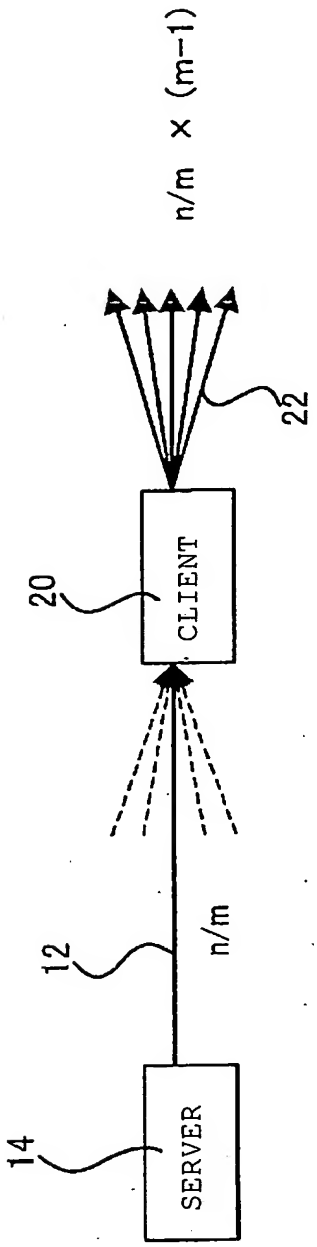

FIG. 6

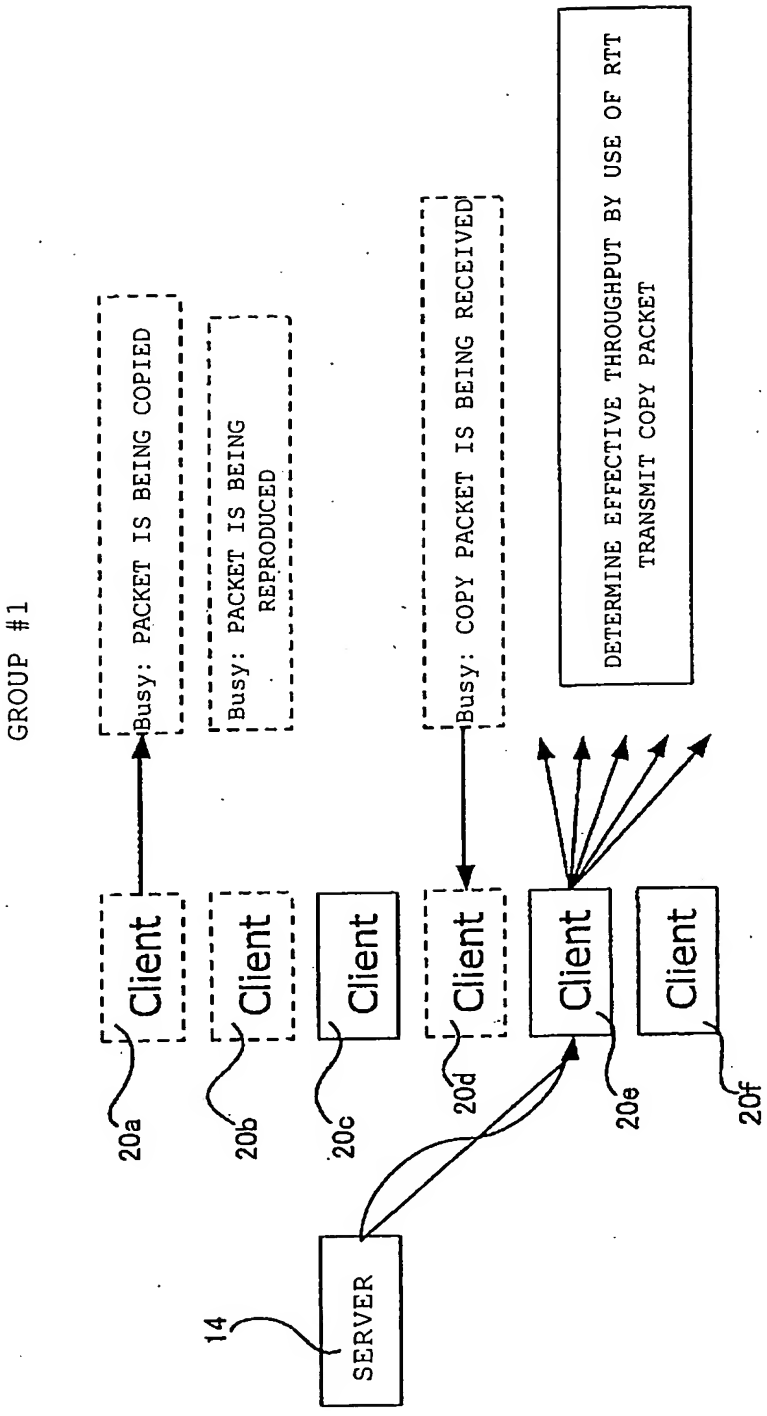
GROUP #1
Busy: PACKET IS BEING COPIED
Busy: PACKET IS BEING REPRODUCED
Busy: COPY PACKET IS BEING RECEIVED
DETERMINE EFFECTIVE THROUGHPUT BY USE OF RTT
TRANSMIT COPY PACKET
Client
Client
Client
Client
Client
Client
20a
20b
20c
20d
20e
20f
SERVER
14

FIG. 7

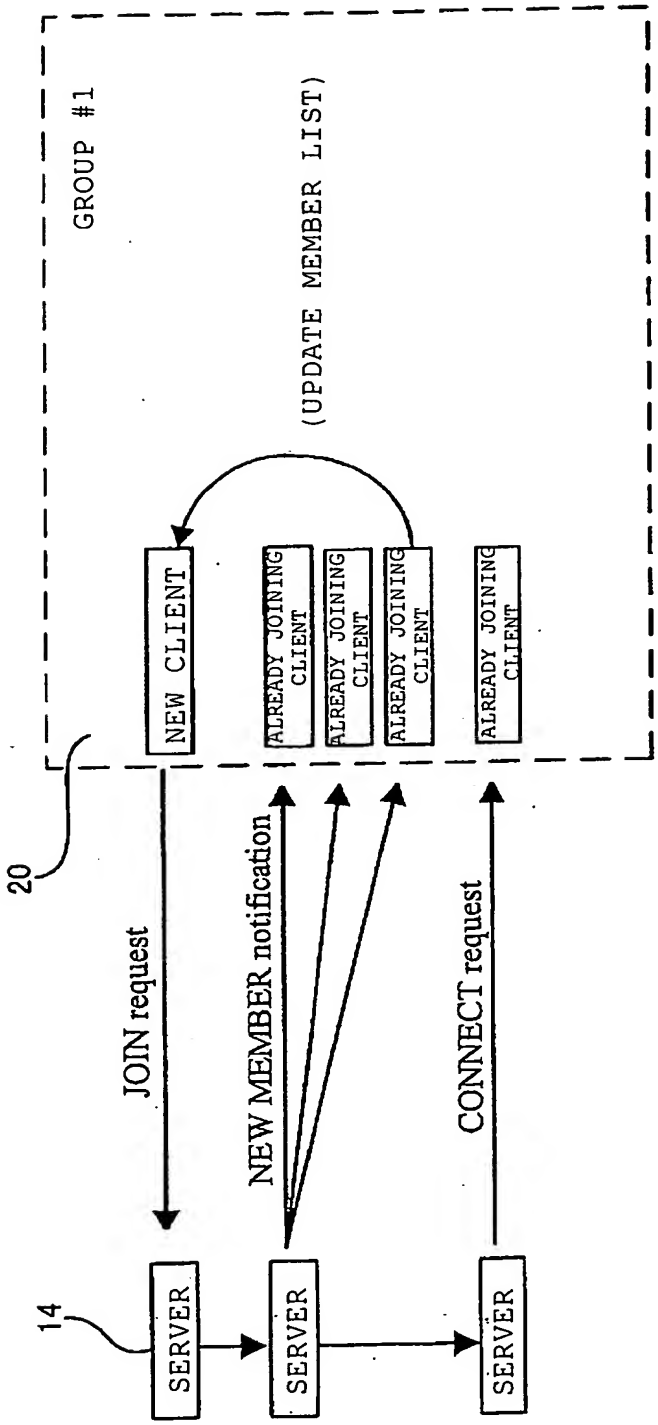
GROUP #1
(UPDATE MEMBER LIST)
NEW CLIENT
ALREADY JOINING CLIENT
ALREADY JOINING CLIENT
ALREADY JOINING CLIENT
ALREADY JOINING CLIENT
20
JOIN request
NEW MEMBER notification
CONNECT request
14
SERVER
SERVER
SERVER

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FIG.8

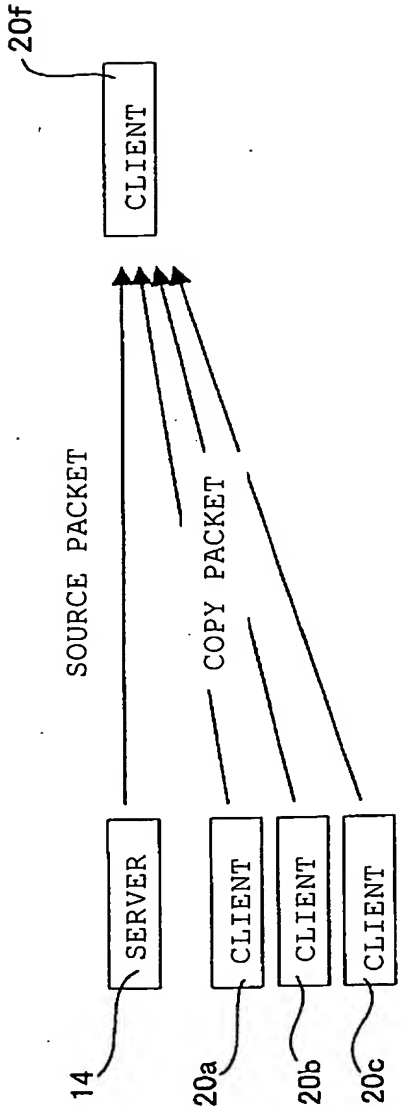

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FIG. 9

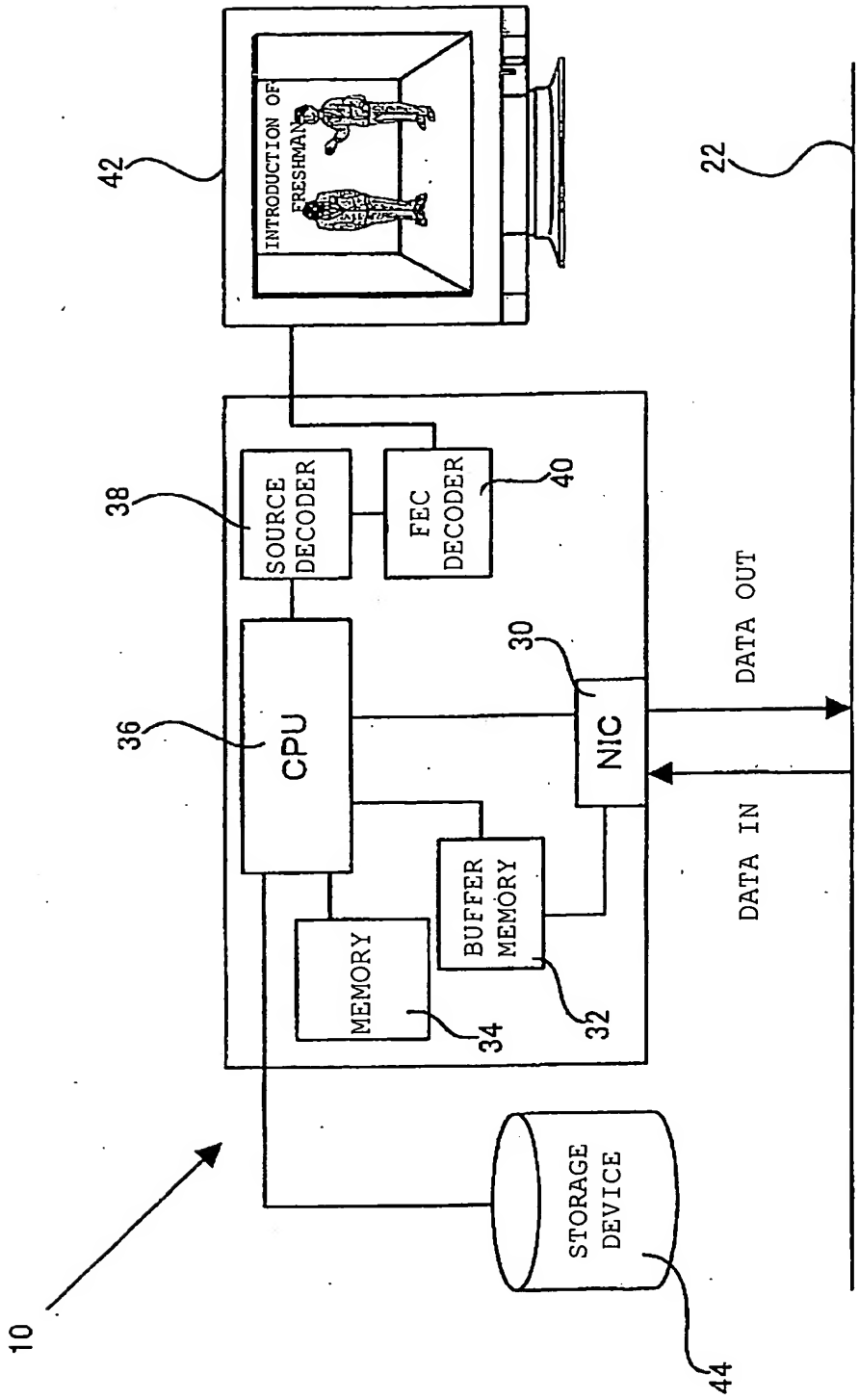

FIG.10

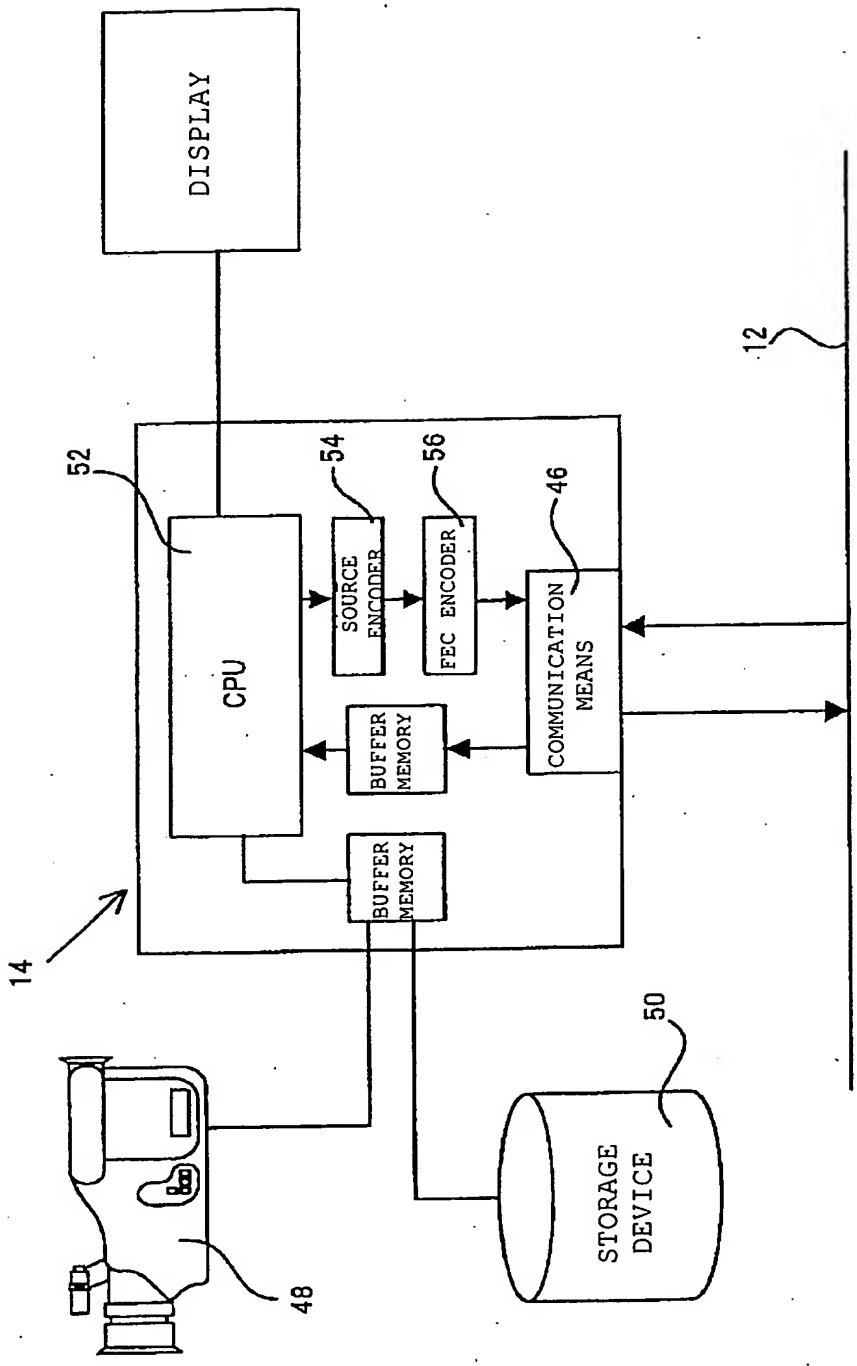
DISPLAY
12
52
54
56
46
CPU
SOURCE ENCODER
FEC ENCODER
COMMUNICATION MEANS
BUFFER MEMORY
BUFFER MEMORY
14
50
STORAGE DEVICE
48

FIG.11

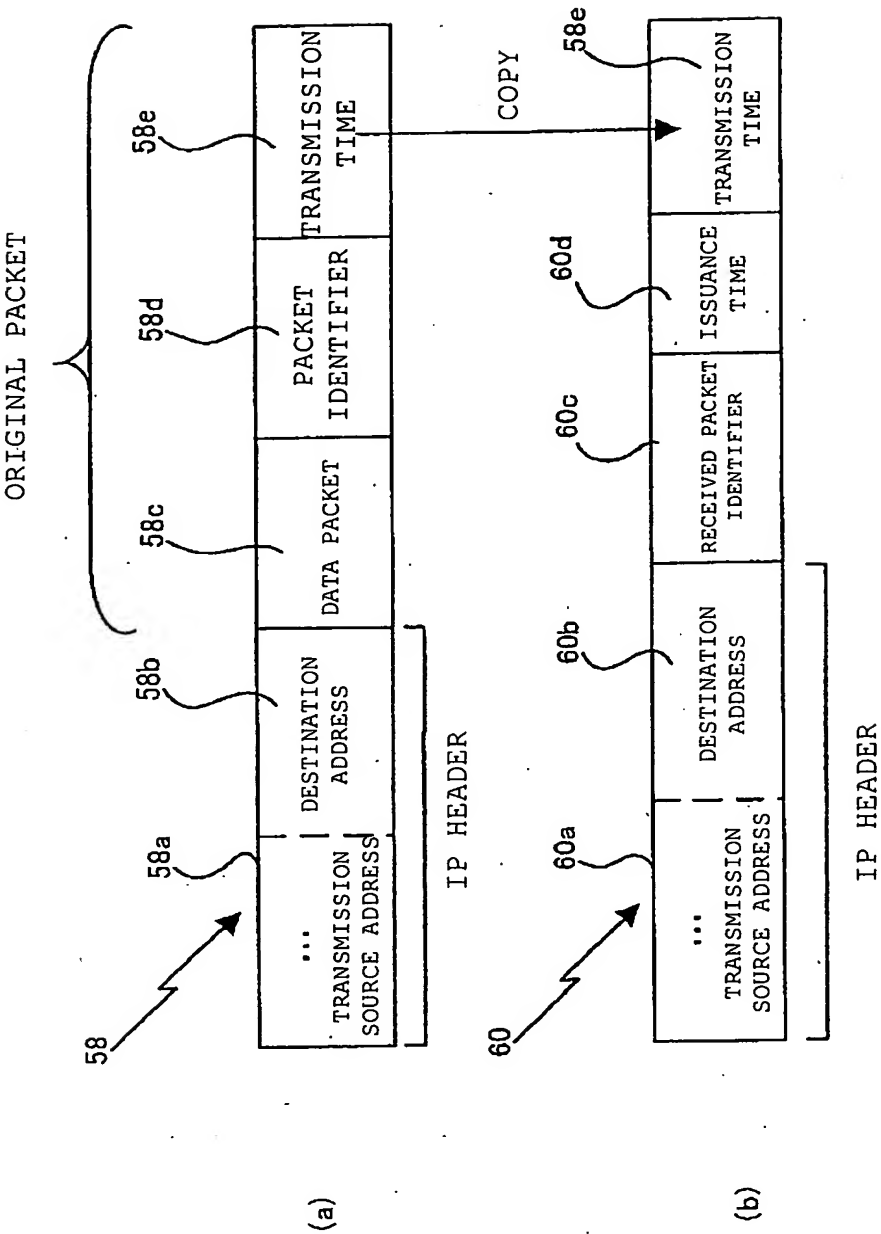
ORIGINAL PACKET
58
58a
58b
58c
58d
58e
TRANSMISSION SOURCE ADDRESS
DESTINATION ADDRESS
DATA PACKET
PACKET IDENTIFIER
TRANSMISSION TIME
IP HEADER
(a)
COPY
60
60a
60b
60c
60d
60e
TRANSMISSION SOURCE ADDRESS
DESTINATION ADDRESS
RECEIVED PACKET IDENTIFIER
ISSUANCE TIME
TRANSMISSION TIME
IP HEADER
(b)

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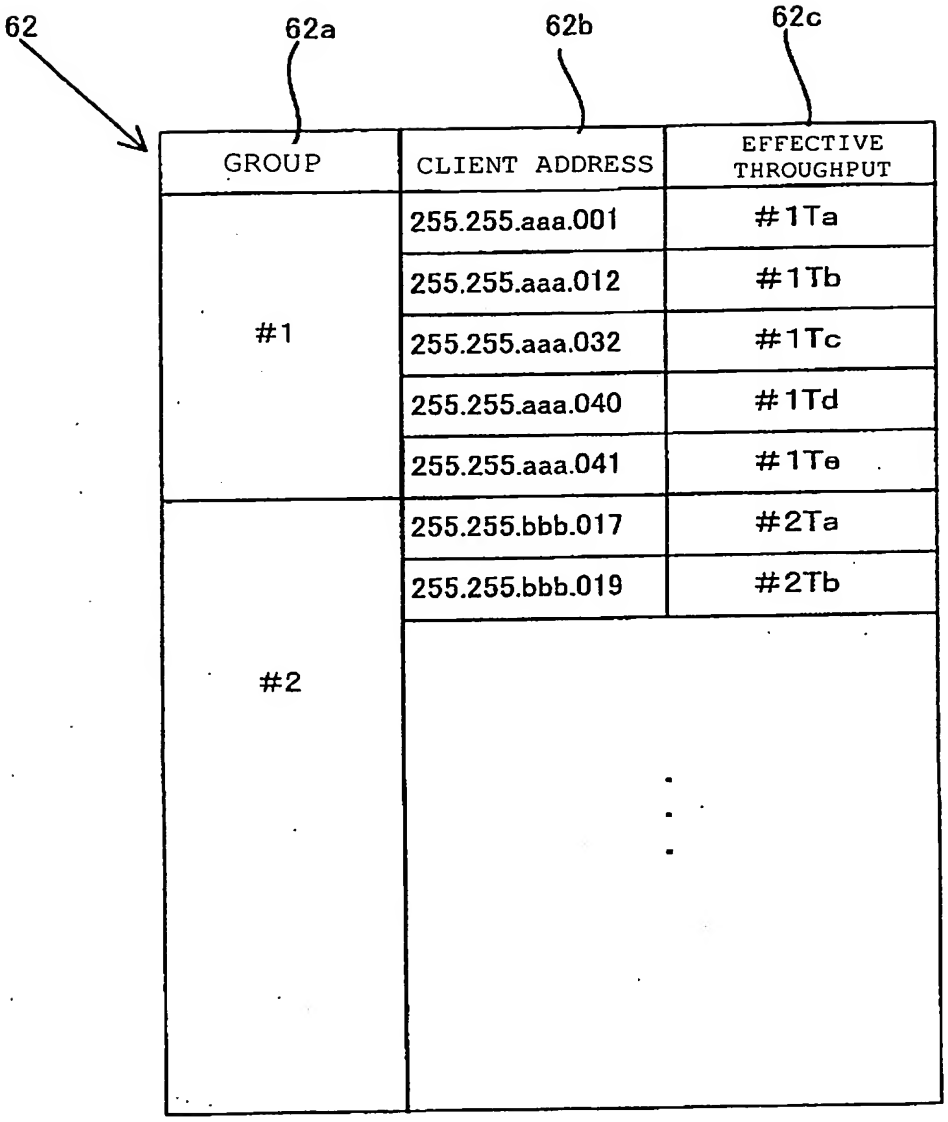
FIG.12



GROUP	CLIENT ADDRESS	EFFECTIVE THROUGHPUT
#1	255.255.aaa.001	#1Ta
	255.255.aaa.012	#1Tb
	255.255.aaa.032	#1Tc
	255.255.aaa.040	#1Td
	255.255.aaa.041	#1Te
#2	255.255.bbb.017	#2Ta
	255.255.bbb.019	#2Tb

FIG.13

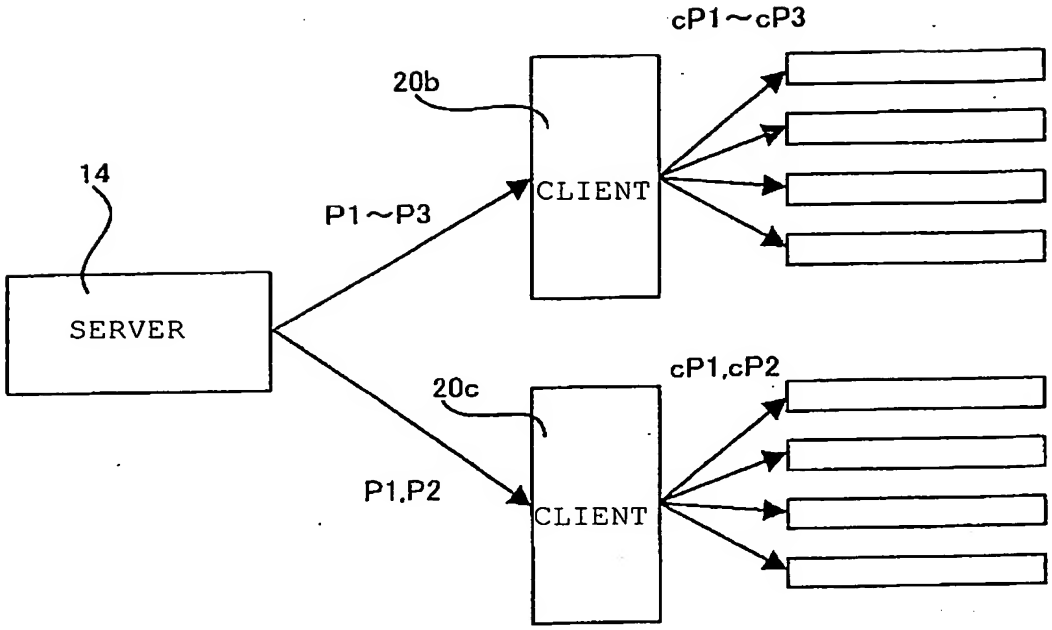


FIG.14

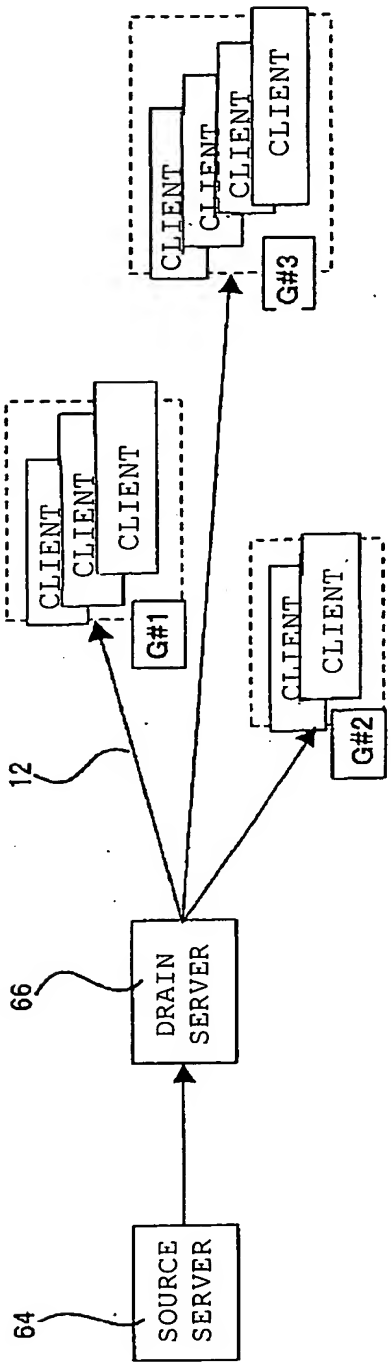

CLIENT
CLIENT
CLIENT
CLIENT
G#3
CLIENT
CLIENT
CLIENT
G#1
CLIENT
CLIENT
G#2
12
66
DRAIN SERVER
64
SOURCE SERVER

FIG.15

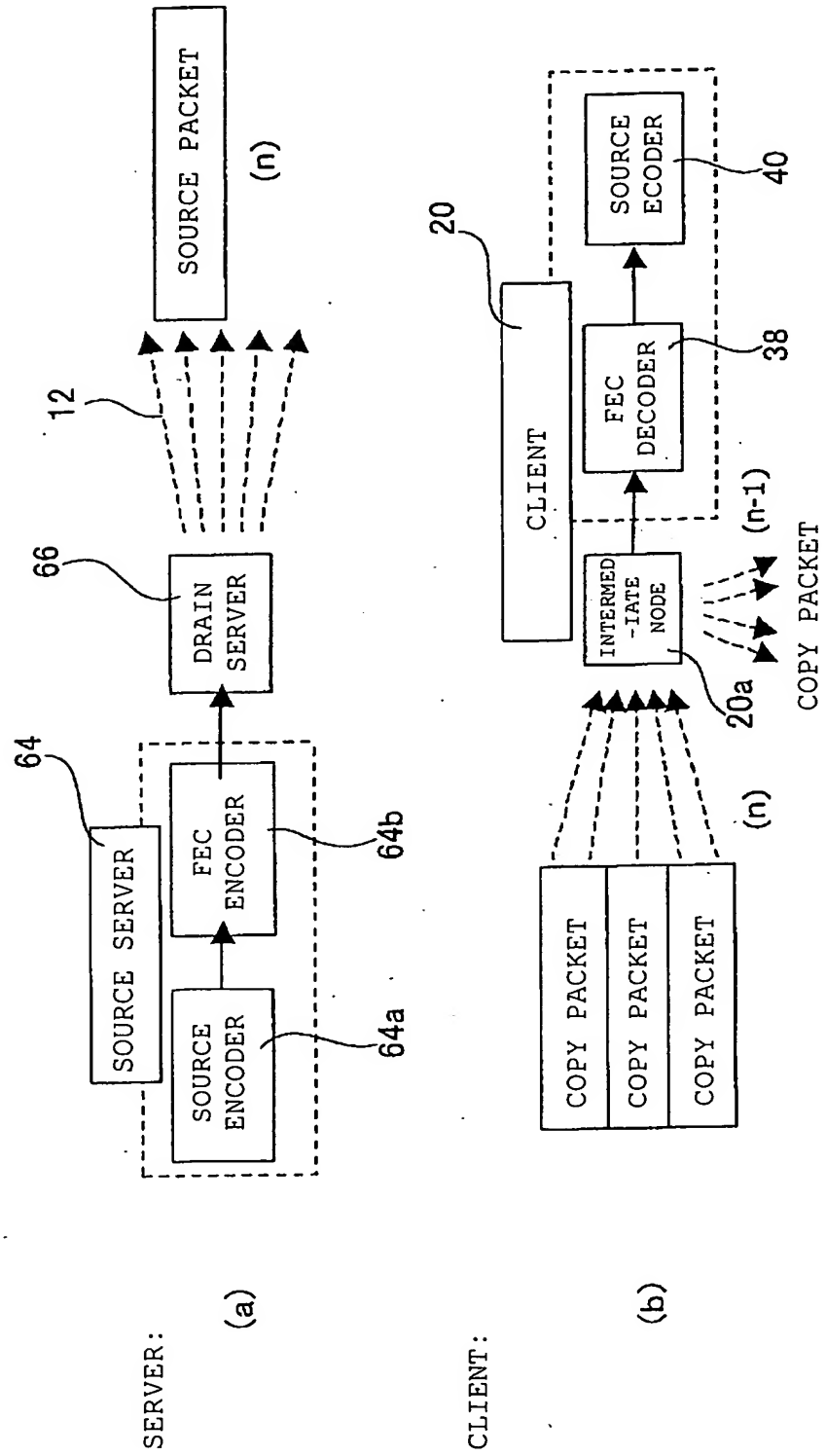

SOURCE PACKET
(n)
12
66
DRAIN SERVER
64
SOURCE SERVER
FEC ENCODER
64b
SOURCE ENCODER
64a
SERVER:
(a)
20
CLIENT
SOURCE ECODER
40
FEC DECODER
38
(n-1)
INTERMED-IATE NODE
20a
COPY PACKET
(n)
COPY PACKET
COPY PACKET
COPY PACKET
CLIENT:
(b)

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FIG.16

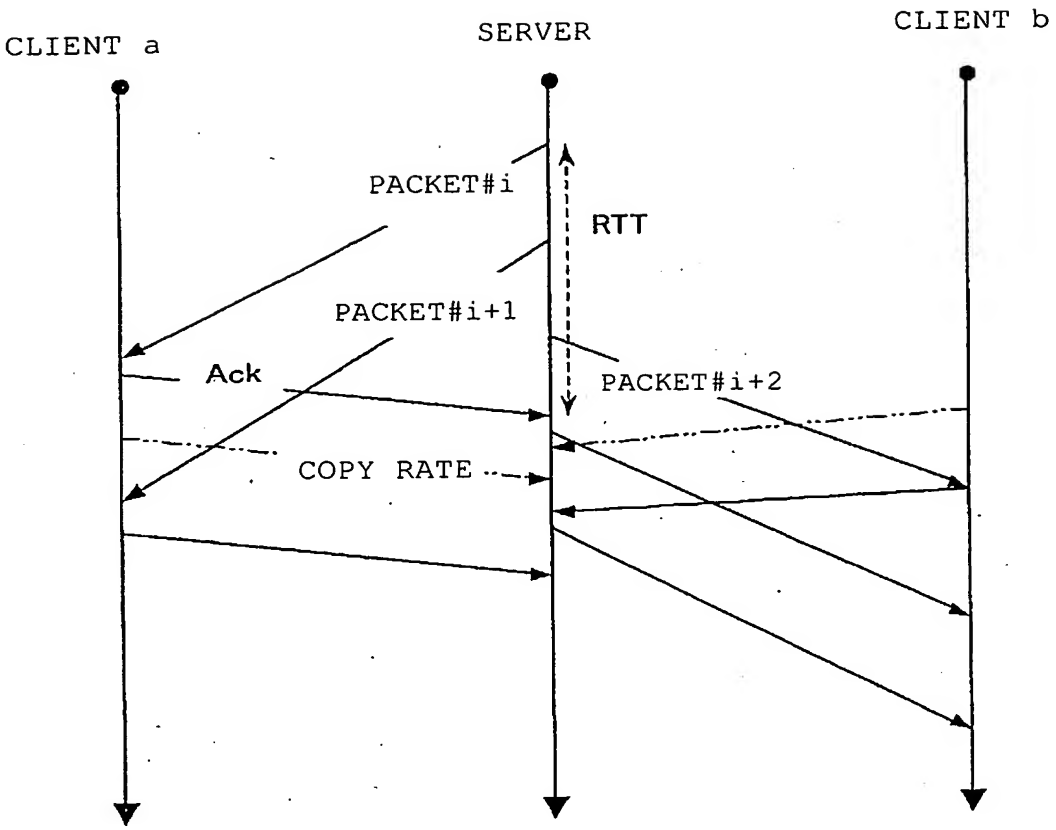

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FIG.17

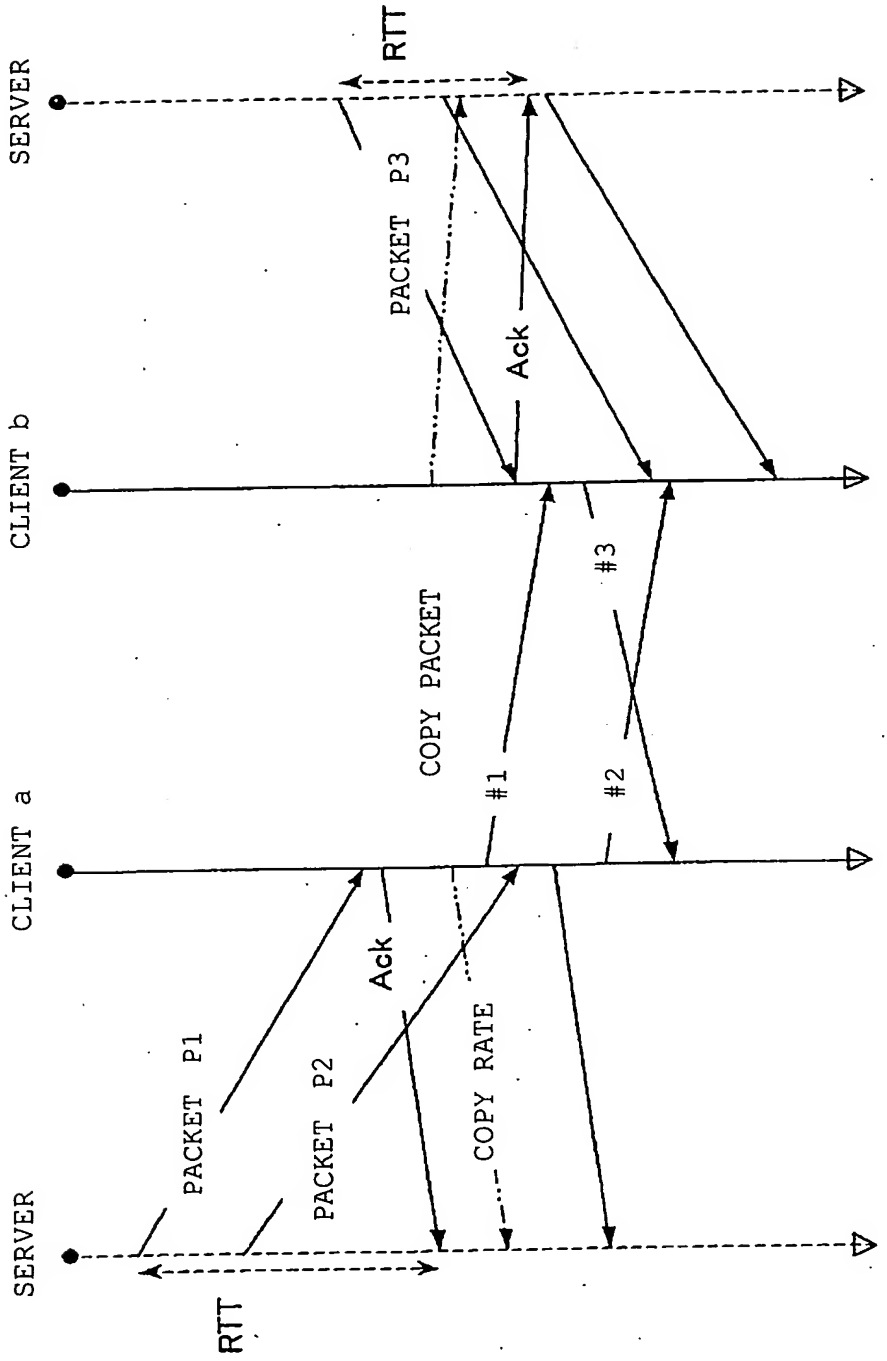


FIG.18

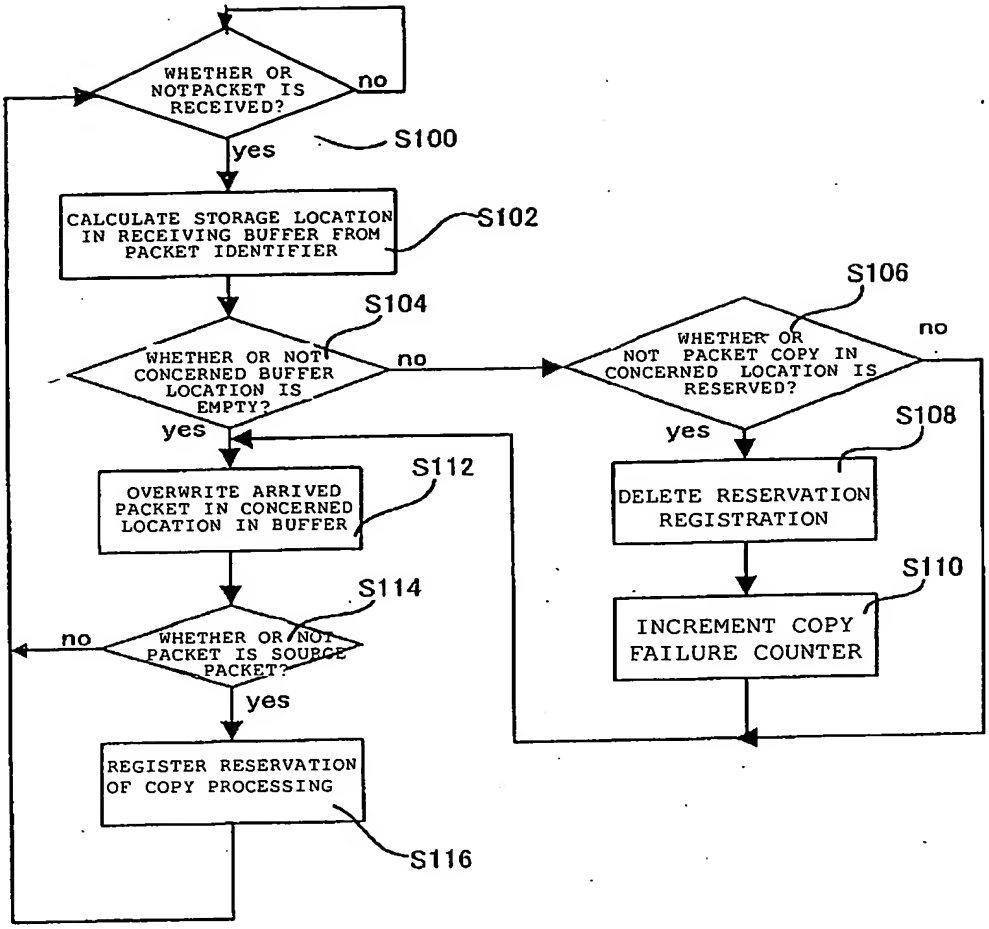
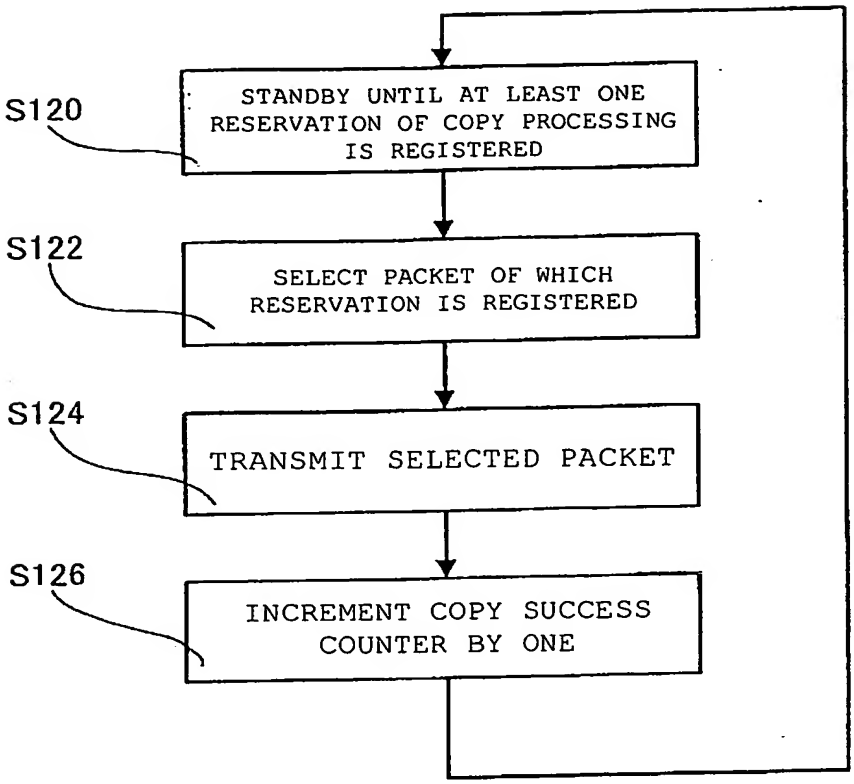
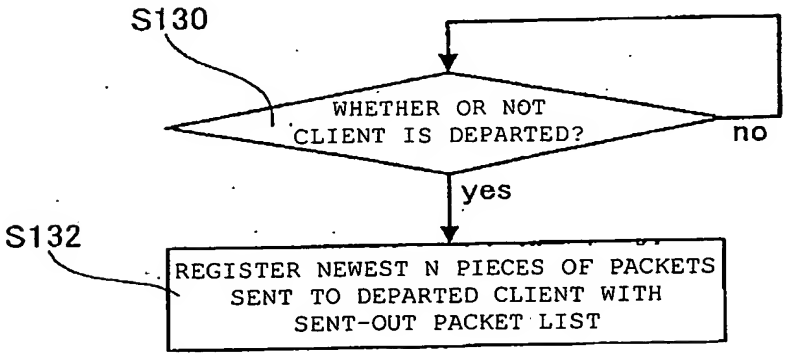

WHETHER OR NOTPACKET IS RECEIVED?
no
yes
S100
CALCULATE STORAGE LOCATION IN RECEIVING BUFFER FROM PACKET IDENTIFIER
S102
S104
WHETHER OR NOT CONCERNED BUFFER LOCATION IS EMPTY?
no
yes
S106
WHETHER OR NOT PACKET COPY IN CONCERNED LOCATION IS RESERVED?
no
yes
S108
DELETE RESERVATION REGISTRATION
S110
INCREMENT COPY FAILURE COUNTER
S112
OVERWRITE ARRIVED PACKET IN CONCERNED LOCATION IN BUFFER
S114
WHETHER OR NOT PACKET IS SOURCE PACKET?
no
yes
REGISTER RESERVATION OF COPY PROCESSING
S116

FIG.19


S120
STANDBY UNTIL AT LEAST ONE RESERVATION OF COPY PROCESSING IS REGISTERED
S122
SELECT PACKET OF WHICH RESERVATION IS REGISTERED
S124
TRANSMIT SELECTED PACKET
S126
INCREMENT COPY SUCCESS COUNTER BY ONE

(a)


S130
WHETHER OR NOT CLIENT IS DEPARTED?
no
yes
S132
REGISTER NEWEST N PIECES OF PACKETS SENT TO DEPARTED CLIENT WITH SENT-OUT PACKET LIST

(b)

FIG.20

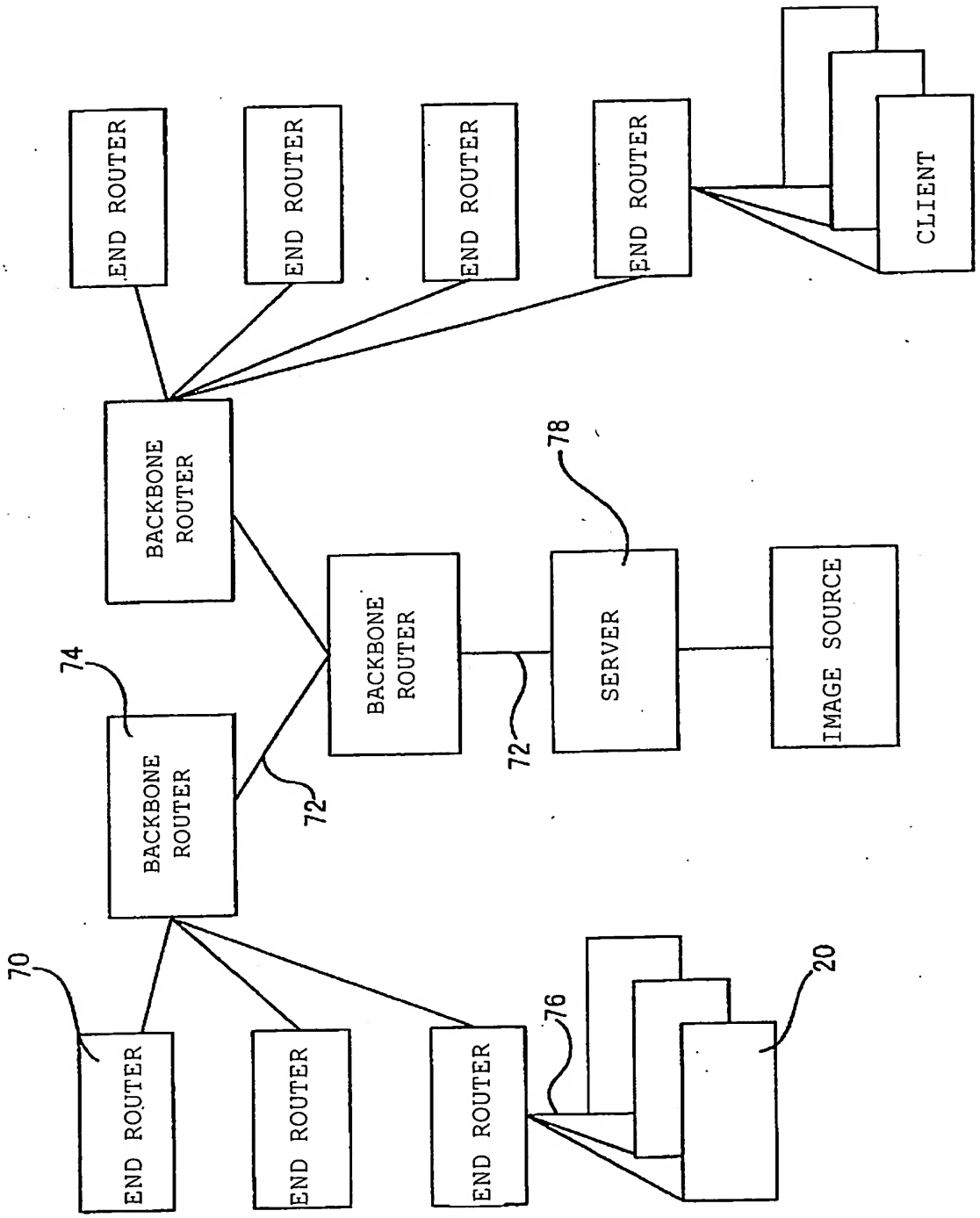

END ROUTER
END ROUTER
END ROUTER
END ROUTER
CLIENT
BACKBONE ROUTER
78
BACKBONE ROUTER
SERVER
IMAGE SOURCE
74
72
72
BACKBONE ROUTER
70
END ROUTER
END ROUTER
END ROUTER
76
20

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FIG.21

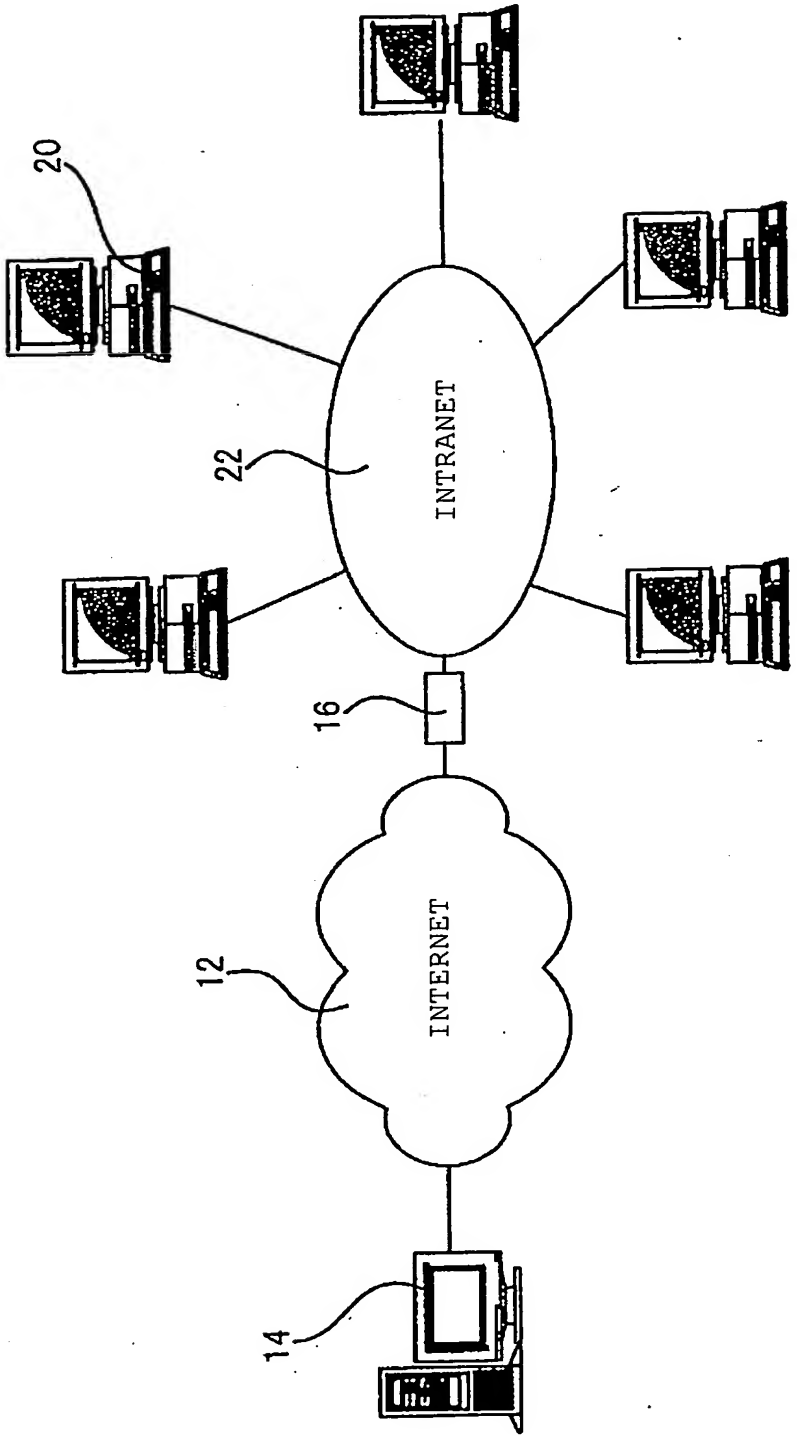

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FIG.22

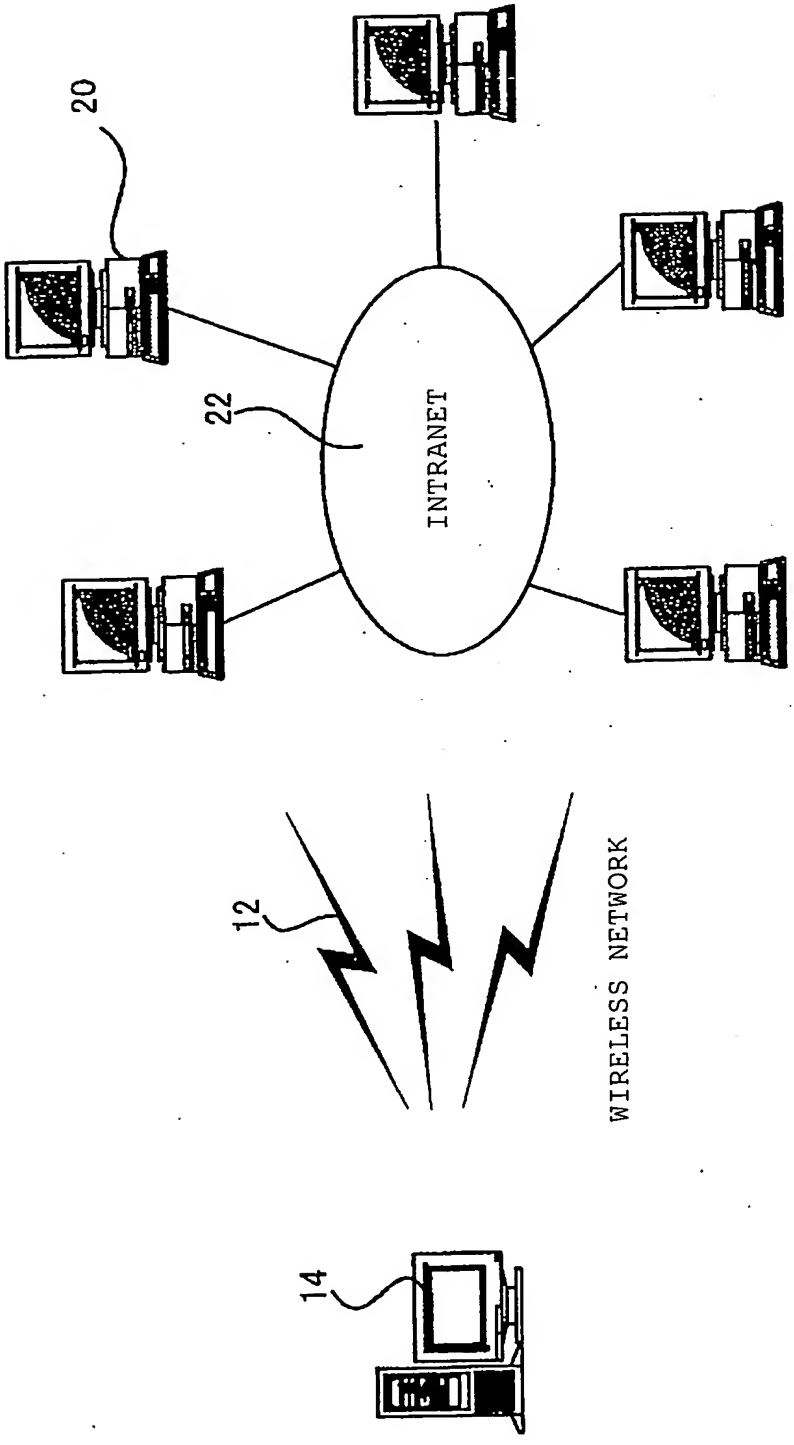


FIG.23

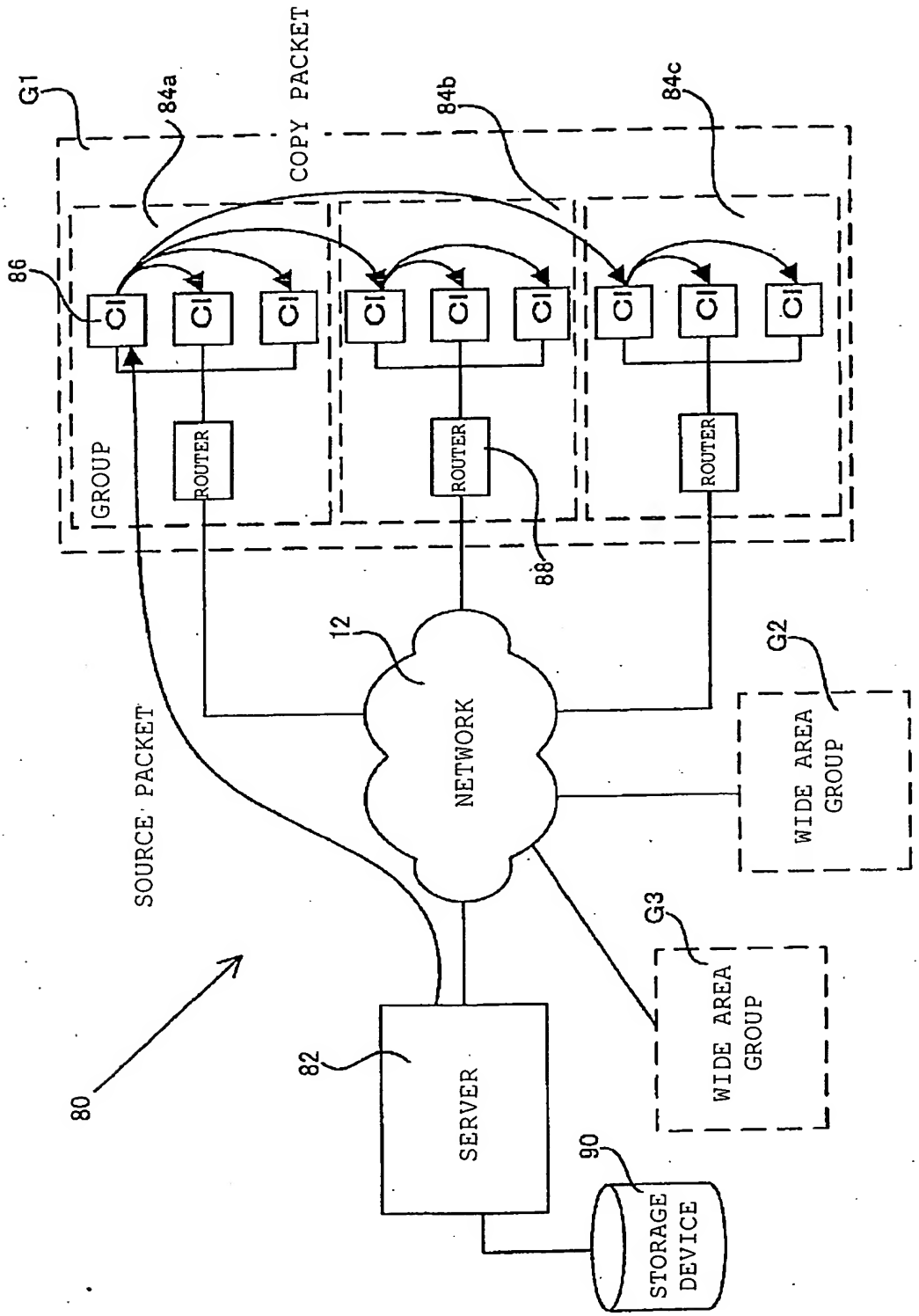

G1
84a
COPY PACKET
84b
84c
86
CI
CI
CI
CI
CI
CI
CI
CI
CI
GROUP
ROUTER
ROUTER
ROUTER
88
12
NETWORK
G2
WIDE AREA GROUP
SOURCE PACKET
G3
WIDE AREA GROUP
80
82
SERVER
90
STORAGE DEVICE

FIG.24

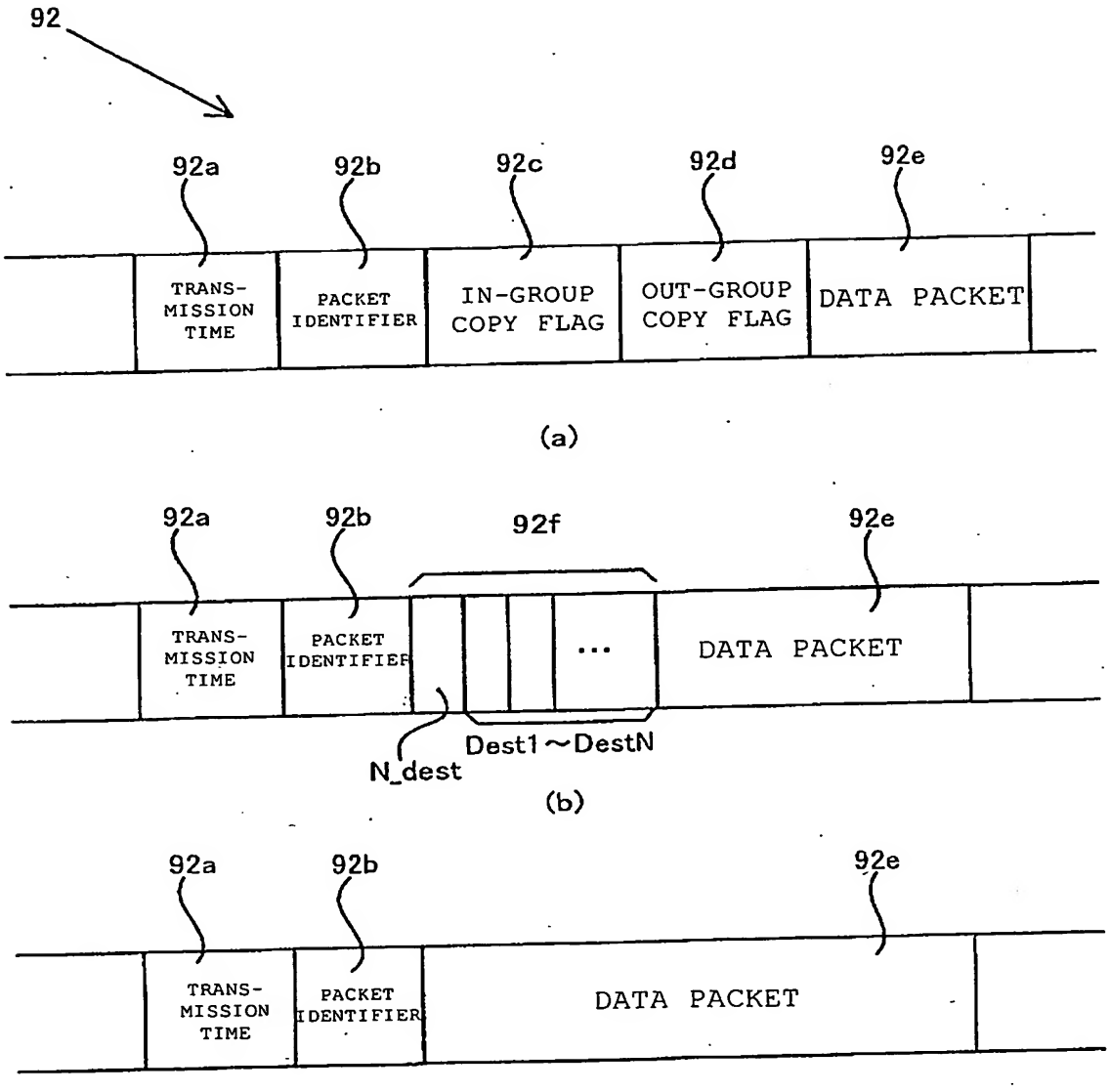

92
92a
92b
92c
92d
92e
TRANS-MISSION TIME
PACKET IDENTIFIER
IN-GROUP COPY FLAG
OUT-GROUP COPY FLAG
DATA PACKET
(a)
92a
92b
92f
92e
TRANS-MISSION TIME
PACKET IDENTIFIER
...
DATA PACKET
N_dest
Dest1～DestN
(b)
92a
92b
92e
TRANS-MISSION TIME
PACKET IDENTIFIER
DATA PACKET
(c)

FIG.25

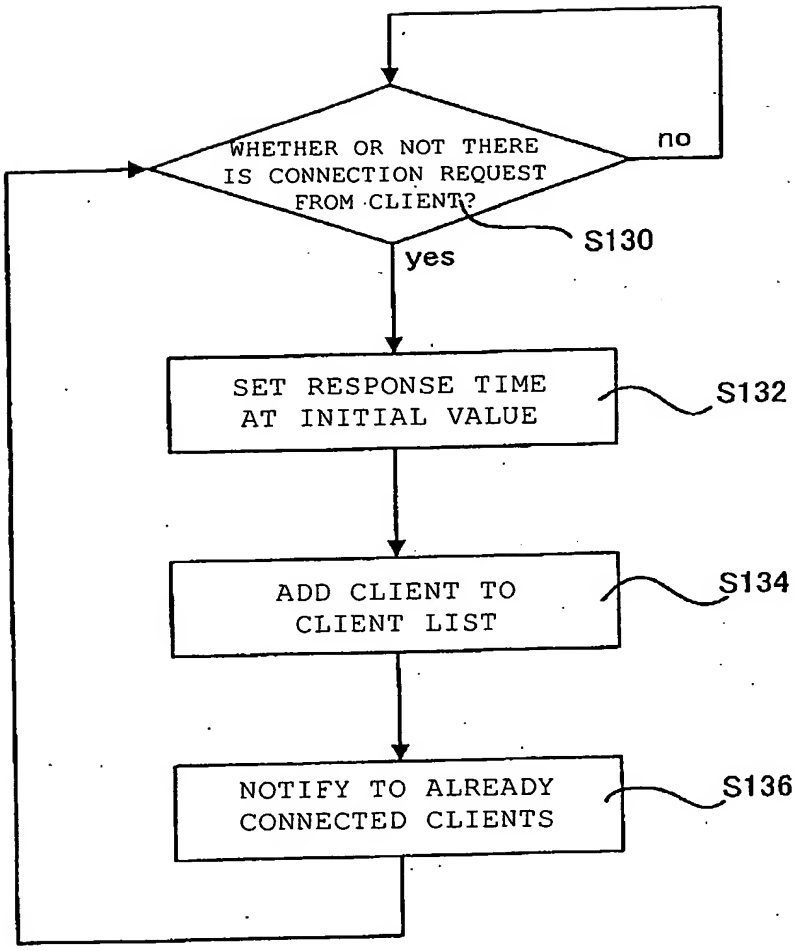

WHETHER OR NOT THERE IS CONNECTION REQUEST FROM CLIENT?
no
S130
yes
SET RESPONSE TIME AT INITIAL VALUE
S132
ADD CLIENT TO CLIENT LIST
S134
NOTIFY TO ALREADY CONNECTED CLIENTS
S136

FIG.26

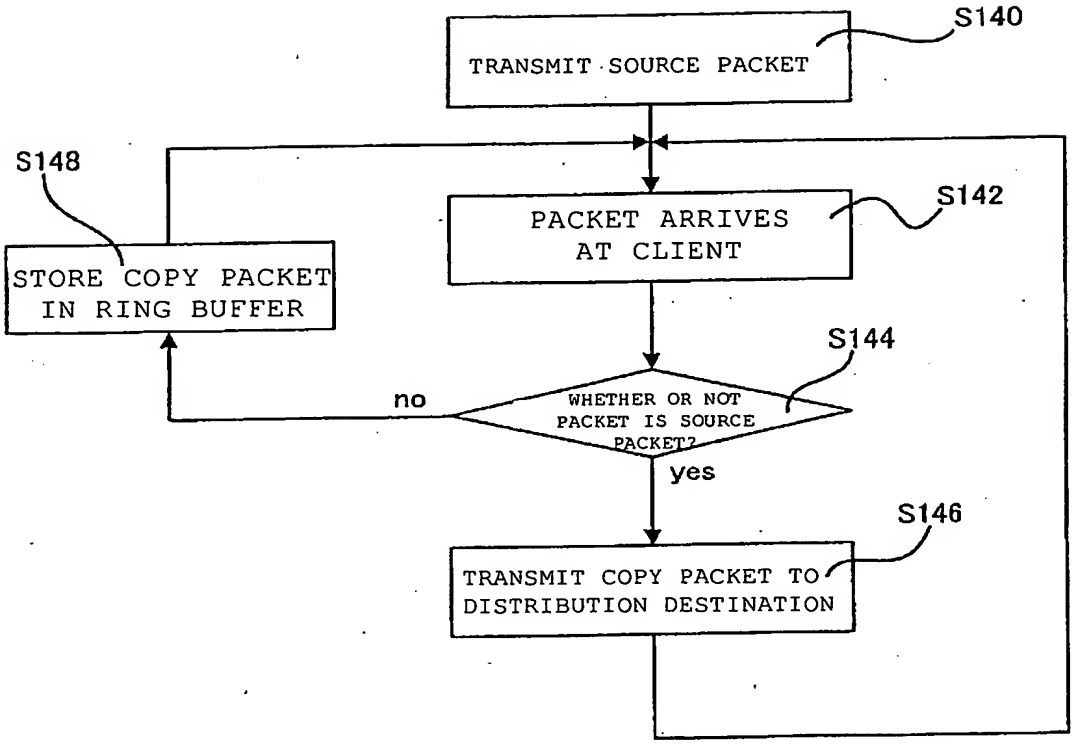

TRANSMIT SOURCE PACKET
S140
PACKET ARRIVES AT CLIENT
S142
WHETHER OR NOT PACKET IS SOURCE PACKET?
S144
no
yes
STORE COPY PACKET IN RING BUFFER
S148
TRANSMIT COPY PACKET TO DISTRIBUTION DESTINATION
S146

FIG.27

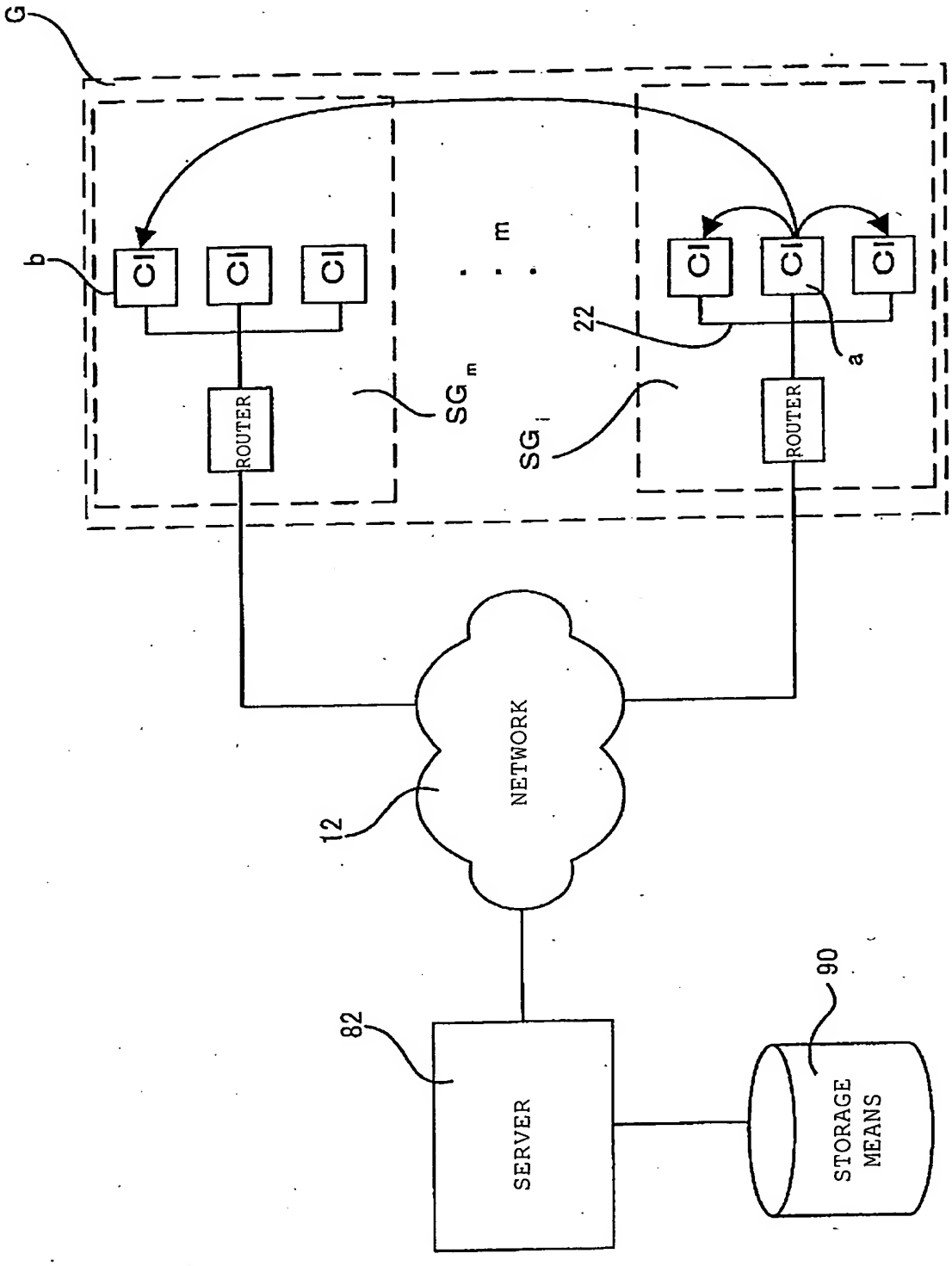

G
b
CI
CI
CI
m
CI
CI
CI
22
a
ROUTER
ROUTER
SG m
SG i
NETWORK
12
82
SERVER
90
STORAGE MEANS

FIG.28

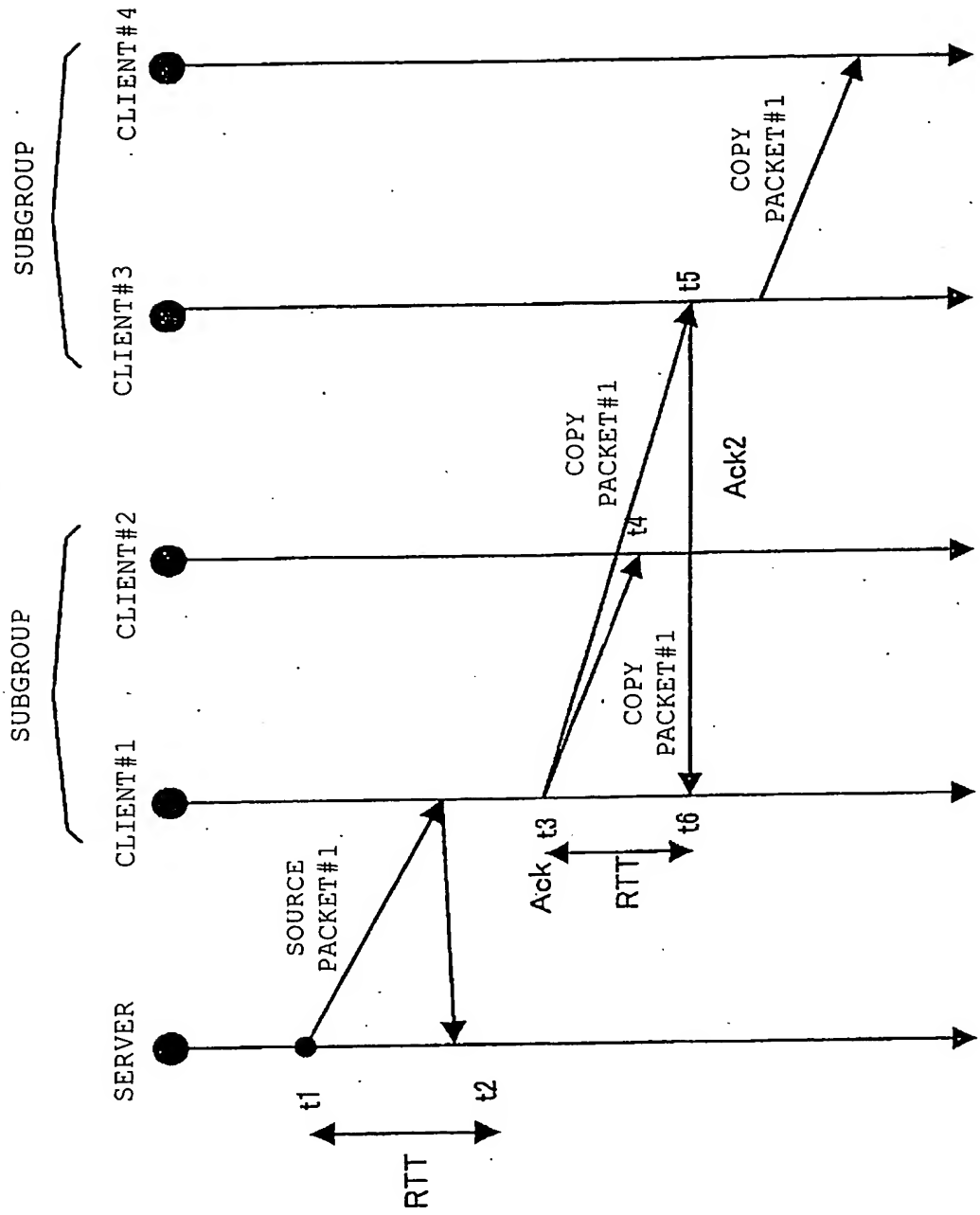

SUBGROUP
SUBGROUP
CLIENT#4
CLIENT#3
CLIENT#2
CLIENT#1
SERVER
SOURCE PACKET#1
COPY PACKET#1
COPY PACKET#1
COPY PACKET#1
Ack
Ack2
t1
t2
t3
t4
t5
t6
RTT
RTT

FIG.29

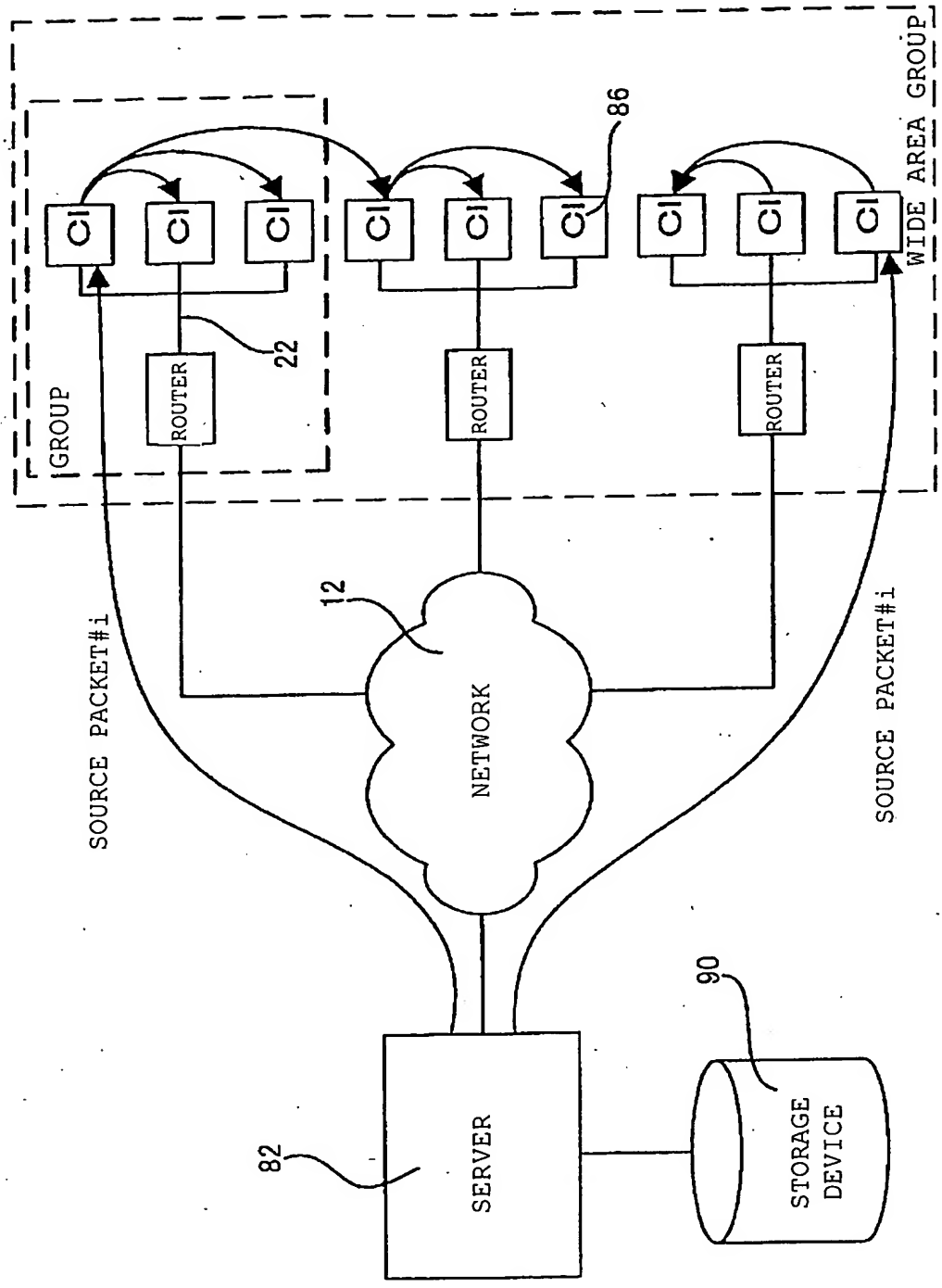

WIDE AREA GROUP
GROUP
CI
CI
CI
CI
CI
CI
CI
CI
CI
86
22
ROUTER
ROUTER
ROUTER
12
NETWORK
SOURCE PACKET#i
SOURCE PACKET#i
90
82
SERVER
STORAGE DEVICE

FIG.30

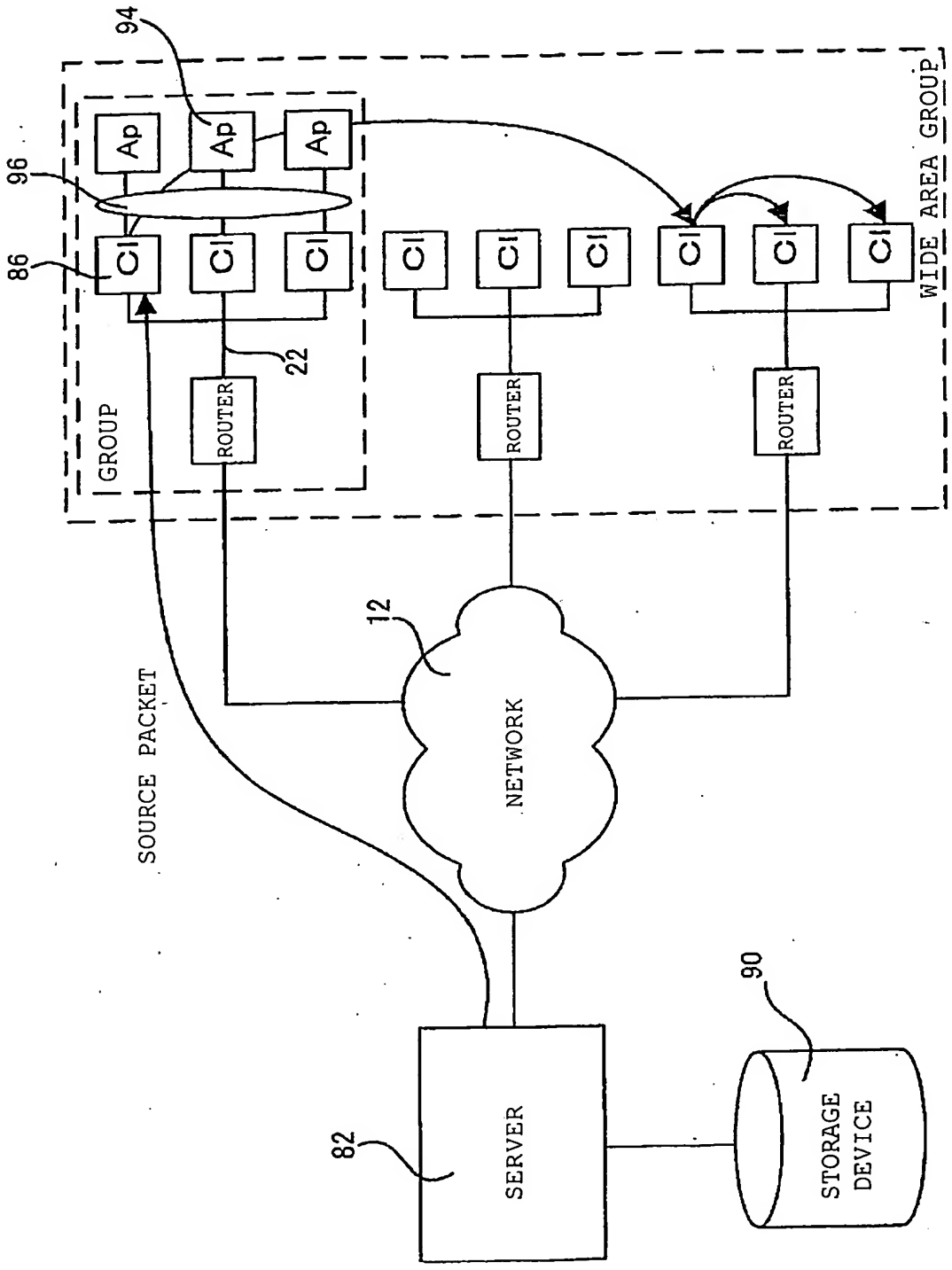

94
96
86
Ap
Ap
Ap
CI
CI
CI
CI
CI
CI
CI
CI
CI
22
ROUTER
ROUTER
ROUTER
GROUP
WIDE AREA GROUP
12
NETWORK
SOURCE PACKET
90
82
SERVER
STORAGE DEVICE

FIG.31

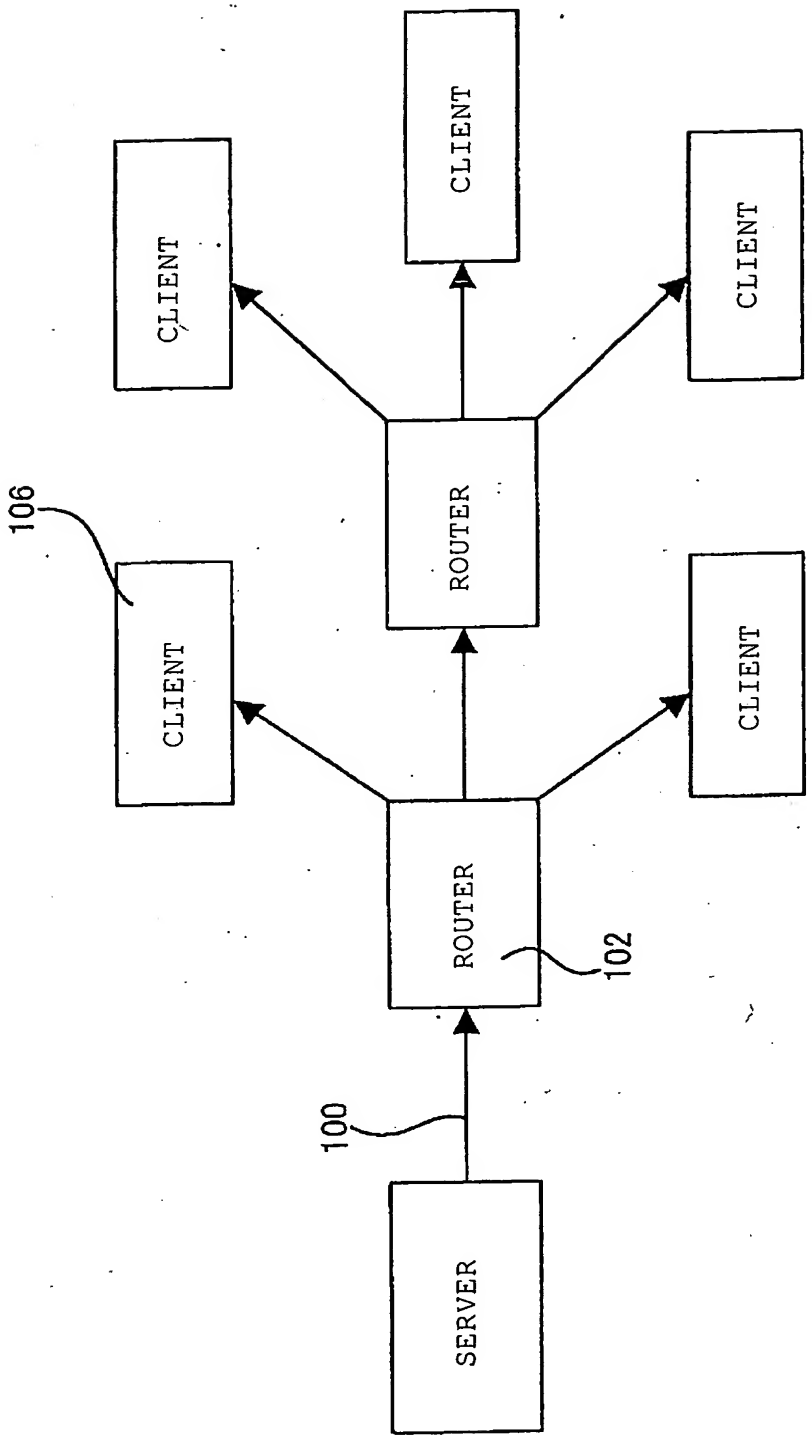

CLIENT
CLIENT
CLIENT
106
ROUTER
CLIENT
CLIENT
ROUTER
102
100
SERVER

FIG. 32

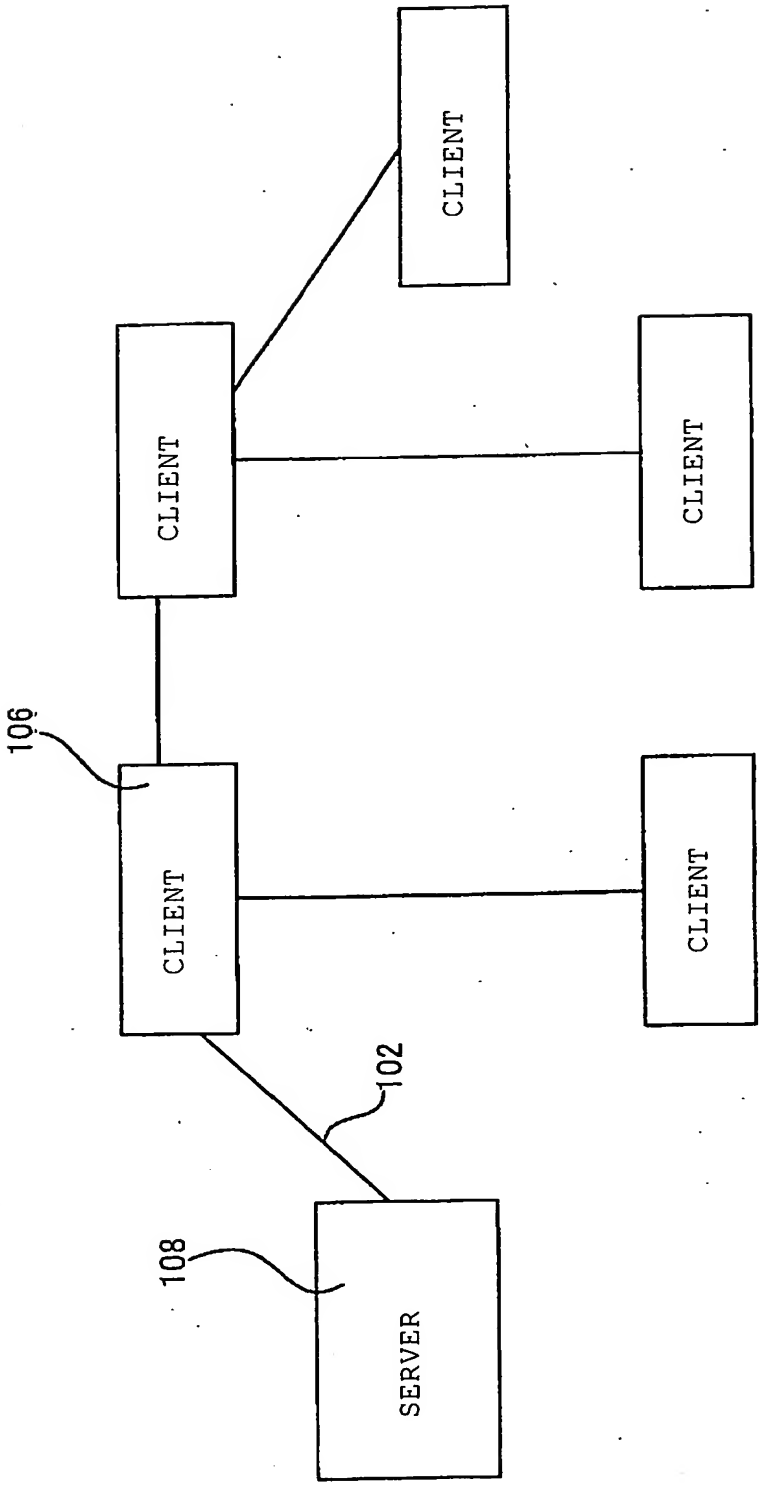


FIG. 33

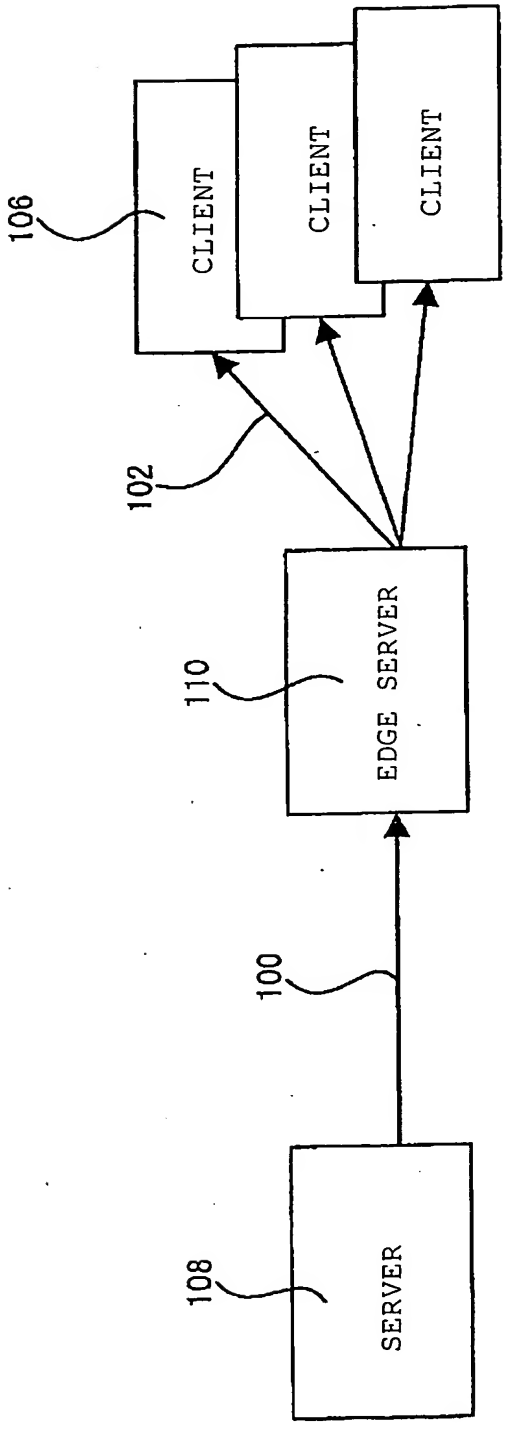


FIG. 34

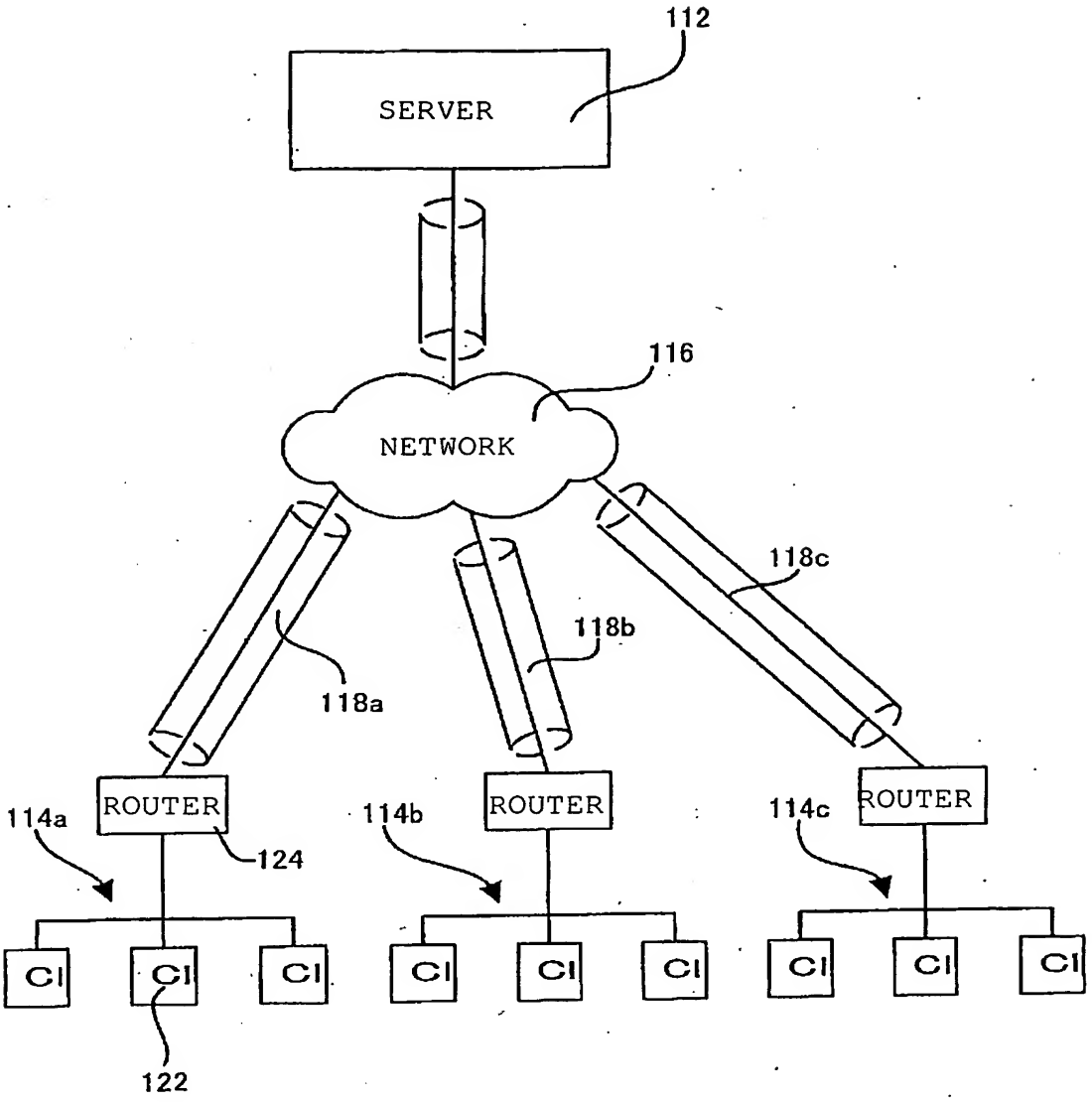
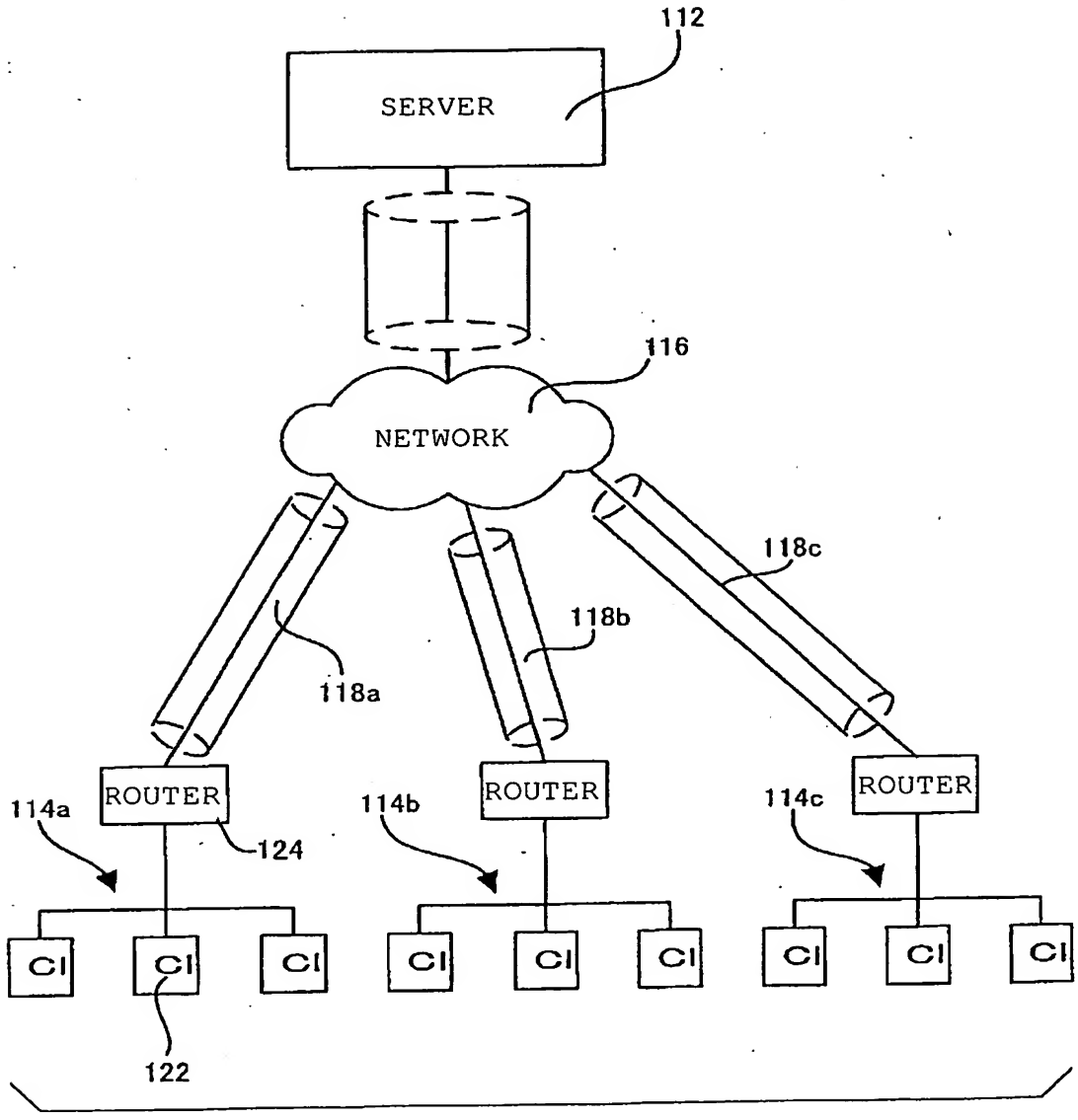

112
SERVER
116
NETWORK
118a
118b
118c
ROUTER
ROUTER
ROUTER
114a
114b
114c
124
CI
CI
CI
CI
CI
CI
CI
CI
CI
122

FIG. 35


112
SERVER
116
NETWORK
118a
118b
118c
ROUTER
ROUTER
ROUTER
114a
114b
114c
124
CI
CI
CI
CI
CI
CI
CI
CI
CI
122
M